SCIENTIFIC AMERICAN

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March 6, 1915

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New York, N. Y.

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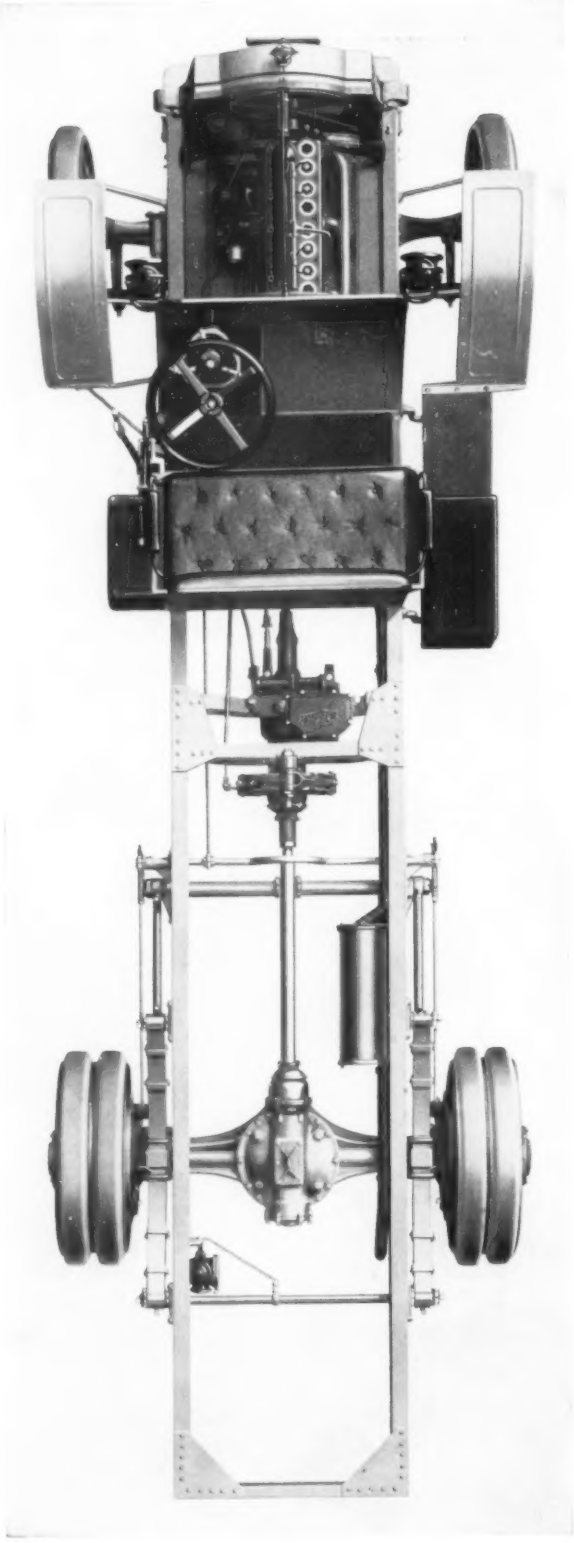

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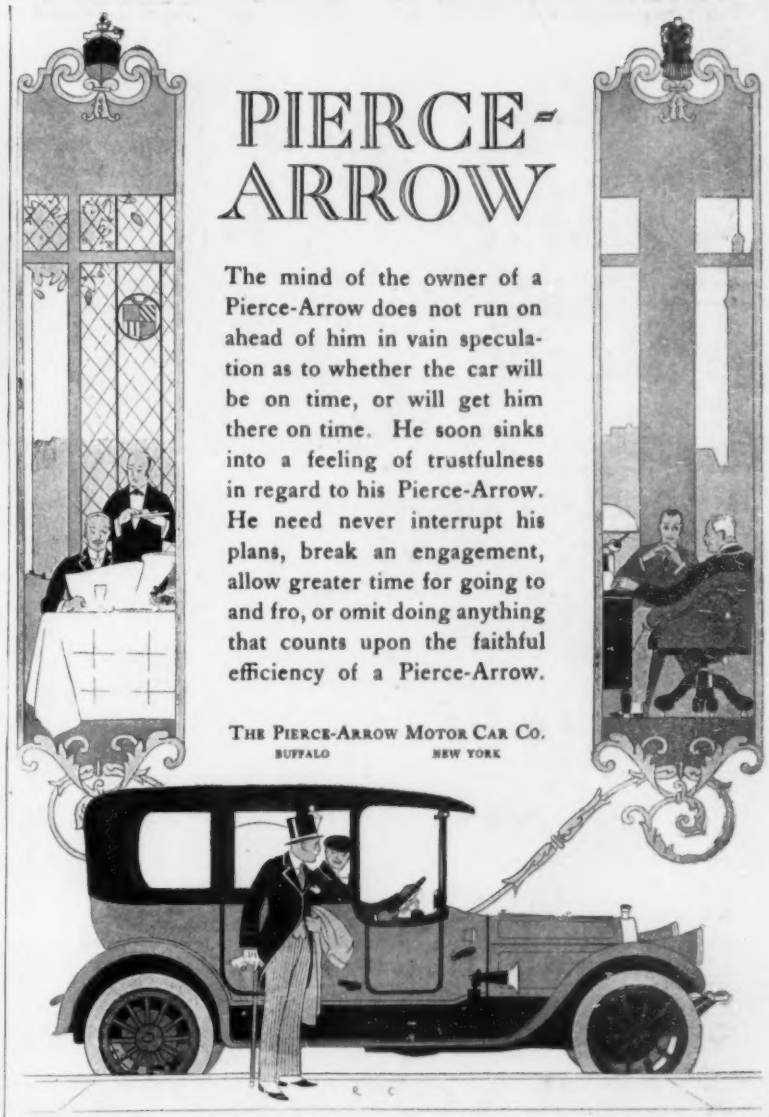

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(2134)

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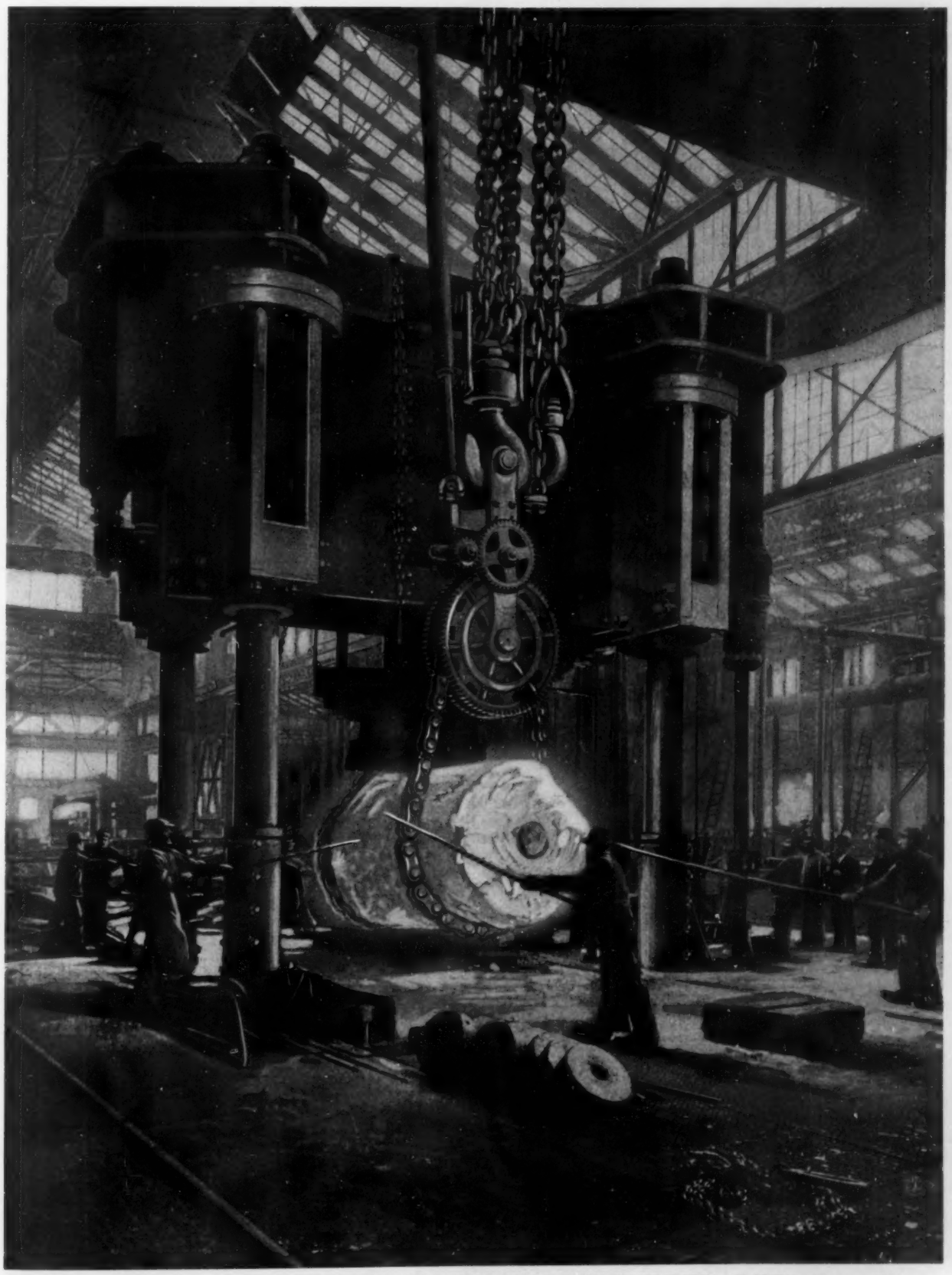

FORGING INNER TUBE FOR A GERMAN 16.8-INCH SIEGE GUN IN THE FAMOUS KRUPP WORKS AT ESSEN.—[See page 216.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

General Locomotive

THE decisive factor in the titanic struggle which is sweeping to and fro over the plains of Poland and East Prussia is not Gen. von Hindenburg nor Grand Duke Nicholas, but Gen. Locomotive.

After giving due credit to the strategical skill of the German and Russian generals, to the wonderful military efficiency of the German army, and to the traditional stubbornness and bravery of the Russian infantry, it has become evident during the first six months of the great war that the fundamental determining condition of success, for one side or the other, is the propinquity of the contending armies to the network of military railroads which approaches and everywhere covers the German frontiers.

One of the most illuminating bits of literature which anyone can read at the present time is the second chapter of Gen. Kouropatkin's great work entitled "The Russian Army and the Japanese War." Gen. Kouropatkin, as we all know, was the commander-in-chief of the Russian armies during the greater part of that memorable conflict. At the conclusion of the war he retired to his estates in Russia and devoted his time to writing this voluminous work, the second chapter of the first volume of which is devoted to a discussion of Russia's eleven thousand miles of frontiers in Europe and Asia. At the close of the chapter he says: "An analysis of the strength and resources of our nearest neighbors forced me to the conclusion that our western frontier has never in the whole history of Russia been exposed to such danger in the event of a European war as it is now, and that accordingly the attention of the War Department in the first years of the present century should be confined to strengthening our position on that side and not diverted to aggressive enterprises elsewhere."

Earlier in the chapter, and in explanation of the disadvantageous position of Russia with regard to Germany and Austria, he says: "The German frontier, 738 miles in length, follows no natural feature. Beyond it lies our nearest neighbor—a nation with whom we have been in close social and economic relationship ever since we got into touch with European life." He points out that the principal, and practically decisive, superiority of Germany lies in her railways. "To her seventeen lines," he says, "running to our frontiers, we can oppose only five. This advantage is overwhelming and gives to her and Austria a superiority which can be counterbalanced neither by large numbers nor by bravery."

As regards Austria, he points out that in the matter of railway development, the Austrians have also an enormous advantage. "While they, by means of eight lines of rail containing ten tracks, can run two hundred and sixty trains up to the frontier every twenty-four hours, we can convey troops up to the same point only on four lines." And he gives it as his opinion that Austria can concentrate 1,000,000 men within the area between the Carpathians and the Russian frontier within a very short space of time.

These words were written in 1909; and at the outbreak of the present war Russia was proceeding to put into operation a scheme for giving her army a mobility equal to that of Austria and Germany, by constructing a system of military railroads, leading up to and paralleling her 1,500 miles of frontier which are conterminous with those two countries. The war, however, found Russia in about the same condition of immobility that existed at the time Kouropatkin's book was written; and although the manifest superiority of the Russian troops to those of Austria has enabled Russia to carry the war to the line of the Carpathians, she has never been able to make any advance in force beyond the German frontier except in East Prussia. Here, already, she has suffered the two greatest defeats in her history, and in each case the defeat has been mainly due to the ability of Von Hindenburg to concentrate rapidly against the enemy an overwhelming force which was rushed there over the admirable German system of railroads.

We cannot forbear drawing attention to the fact that, both in the victory at Tannenberg and, apparently, in the recent defeat in East Prussia, the Germans captured, if the reports they have given us are correct, over 90,000 men. That is to say, within a period of six months they have twice captured a military force equal to the whole of the effective regular and militia army at present available in the United States.

Peace Insurance

THAT the cost of providing naval and military forces sufficient to protect this country from invasion may very properly be regarded as money appropriated for the maintenance of peace, is fully borne out by a review of our past military history. That a condition of military preparedness can be obtained at a very small cost compared with the expenditures made by the nation for personal comfort and the luxuries of life, is proved by Governmental statistics. By similar indisputable authority, it can be shown that the loss of life, when war has to be undergone, is amazingly small in comparison to the loss of life which is daily occurring through accidents, the greater part of which are preventable.

The most telling statement of the case which we have seen for a long time is presented by Richard Stockton, Jr., in his work entitled "Peace Insurance"—a book which we commend to the careful perusal of those extreme pacificists who have so far lost their heads, or at least their sense of proportion, as not only to oppose the greatly needed increase in our naval and military forces, but even to advocate the abolition of these altogether.

The most telling portion of the book is a series of diagrams, presenting the whole gist of the argument in a graphic form, the immediate appeal of which is so strong that it must force conviction on any mind that is not absolutely beclouded by prejudice. The diagrams are merely graphic representations of facts which have been taken from carefully-compiled Government statistics, and which, therefore, may be taken as reliable. Thus, we find that the cost of peace insurance amounts annually to $245,000,000, that being the annual appropriation for the maintenance of our Army and Navy. With this may be compared the annual cost of insurance against fire and crime of $594,186,104.

To those people who complain of the shameful waste of the nation's money, entailed in the building of battleships and the manufacture of artillery, we direct attention to the diagram comparing the money spent on the Army and Navy with that expended by the people of this country for the luxuries and indulgences of life. For soft drinks, candy, etc., we spend in the United States, $452,000,000; on automobiles, $500,000,000; on jewelry, $800,000,000; on immorality, $3,000,000,000, and on liquor and tobacco, $3,200,000,000; that is to say, the country spends twenty-five times as much on liquor, tobacco, and vice as it does on its naval and military defenses.

It is a great thing to keep a level head and preserve one's sense of proportion; and if we do this, and look at things as they are, we find that not only is the expense for peace insurance a mere bagatelle compared with what the nation is willing to spend for self-indulgence, but also the surprising discovery is made that the deaths through war do not begin to be comparable to the deaths from accidents due to following the pursuits of peace. In a remarkable diagram Richard Stockton shows that the peace accidents in a single year in this country reach a total of 79,000; whereas the average annual Japanese loss during the Russian war was 33,340; the average annual loss during the civil war was 27,518; the English loss for one year during the Boer war was only 2,990; the French loss in the Crimean war during one year was 8,160, and the English loss in the same year was 2,387; the United States loss in the Mexican war was only 725, and our loss in the Spanish war was only 862. If the totals for all these wars are added together, we find that the total annual loss was 75,982, or 3,000 less than the annual loss in this country from accidents.

Again, we direct attention to a diagram showing what is recommended by way of peace insurance by the General Staff of the United States Army. As matters now stand, we find that for an annual expenditure of $110,000,000 we have an effective strength of the Army and National Guard of 150,000 men. As against that, if the recommendations of the General Staff be followed, for a proposed expenditure of $157,000,000, we shall have an effective army of 550,000 men; that is to say, an increase of $47,000,000 to secure 400,000 additional troops.

As matters now stand, the United States is helpless against invasion; if the General Staff recommendations are followed, we shall be able, by the expenditure of $47,000,000, to insure the peace of the country by discouraging any naval and military attack by a foreign power.

Perfumery Farming in the United States

THE interruption, due to the war, in the supply of many articles of commerce that we have been in the habit of receiving from the Old World has given special point to the perennial question, Can we not produce these things in America? The indications are that the war, especially if it is long protracted, will lead to an economic declaration of independence on the part of this country in many lines of industry.

While the manufacture of perfumery has become an important industry in the United States, the cultivation of perfume-yielding plants in this connection, except a half dozen species which will be mentioned later, is still almost entirely neglected on this side of the Atlantic.

Though a few well-known scents, such as musk and civet, are obtained from animal sources, and certain others can be produced "synthetically" from their chemical elements, the great majority of perfumes are derived from plant products of the class known as volatile or essential oils. These oils are obtained from various parts of the plants in question. They are yielded by the leaves of bay, wintergreen, pine, lemon grass, citronella, patchouli, and rose geranium; by the blossoms of the rose, violet, heliotrope, orange, acacia, jasmine, tuberose, and mignonette; by the flowering heads, including the green parts, of lavender; by the rinds of citrus fruits, including orange, lemon, and bergamot; by the kernels of bitter almonds; by the wood of sandalwood, red cedar, and rhodium; by the inner bark of sweet birch and sassafras; and by the roots of certain species of Iris (orris-root). This list might be extended almost indefinitely.

A few essential oils, including those of peppermint, spearmint, sweet birch, sassafras, eucalyptus, wormwood, and tansy, have been produced more or less extensively in the United States. This fact ought to encourage an investigation of other possibilities in the line of perfume production in this country. Of course, a great many plants from which perfumes are obtained abroad are already in common cultivation for other purposes in the United States. On the other hand, it is probable that our native flora includes a number of species capable of yielding attractive and hitherto unknown perfumes. Desultory experiments have already been made in extracting scents of the yellow jessamine, sweet goldenrod, spice bush, etc., while the swamp magnolia, wild azalea, and wild grape have been suggested as promising sources of perfumery having a market value.

The production of perfume oils abroad has always been markedly localized, from which fact it might be inferred that peculiar conditions of soil or climate are necessary to success in this field. To a certain extent this assumption is correct, for the quality and quantity of the scents produced by certain plants do vary greatly with the conditions under which they are grown. Thus a better grade of lavender is produced in England than in continental Europe, though the species of the plant is the same. The fragrance of roses appears to depend upon abundant sunshine and a moderately rich, but not over-rich, soil. Ample moisture is beneficial for certain scents, but harmful for others. Even so, in the vast area of the United States it seems likely that the physical conditions of each of the most favored perfume-growing regions of Europe might be duplicated. For instance, the climatologist could probably point out regions in this country reproducing very closely the meteorological characteristics of the world-renowned perfume-growing district of Provence, or, again, the sunny slopes of the Balkans, from which comes the best attar of roses. Moreover, it is not impossible that we actually have *more* promising regions for this industry than any of those in which it is now established abroad.

Undoubtedly the amount of hand labor required in perfume farming is the main reason why it has hitherto thriven more in Europe than America. However, in our Southern States, where the climate is, on the whole, most favorable for this branch of agriculture, labor is also comparatively cheap. After the crop is gathered, the various processes employed to obtain the oils—expression, distillation, *enfleurage*, and maceration—do not present great difficulties, and might, indeed, be much improved if Yankee ingenuity were brought to bear upon them.

Notes on the War

Is the "Audacious" Still Afloat?—We note that the leading papers of this city have given publicity to a detailed story to the effect that the "Audacious," which was reported to have been sunk off Lough Swilly, did not actually founder but was towed into port, has been repaired, and has again taken her place in the Grand Fleet. According to this story, immediately after the explosion, collision mats were thrown overboard, and, by means of sandbags and extemporized bulkheads and cofferdams, the inflow of water was so far cut off that the pumps were able to master the situation. The vessel, if we are to credit the report, was towed into Belfast, and repairs were executed with such dispatch that the ship is now in first-class condition.

The Fate of the "Koenigsberg."—But little has been reported of the fate of the German cruiser "Koenigsberg," which was forced to take refuge in the Rufigi River last October by the British cruiser "Chatham." Owing to her greater draught the "Chatham" could not enter the river, and the German vessel was so thoroughly concealed by the surrounding trees and by being covered with foliage that her range could not at first be obtained. To meet these conditions a small crew from the "Chatham" took an English commercial steamer up the channel and sunk her where the hulk would effectually block the escape of the "Koenigsberg." A damaged cable ship was also sunk in the channel. Shortly afterward an aeroplane was shipped to the scene of operations, and the location of the "Koenigsberg" was soon ascertained and the vessel entirely destroyed by the gun-fire of the "Chatham." The German liner "Somali," which acted as a supply ship, was also destroyed.

Science in Warfare.—As soon as the Germans had established a foothold in Belgium a full staff from their observatories was on hand to take up their work in observatories at Liége, Brussels and other places, where they have performed most efficient services for their forces by predictions relating to the weather, particularly in regard to fogs; and this information has been shown to have been of decided value both in the operations of the air fleet and to the submarines as well. This has been demonstrated by the results of the raids by the Germans on Scarborough and Hartlepool, and the operations of the submarines in the Channel, all of which have depended largely on fog conditions for their success. At these observing stations the weather men have not depended altogether on the equipment they found, but have supplemented that by improved instruments they brought with them, and by the use of the testing balloons which they have made use of extensively.

The Soldier's Chances in War.—Basing his estimate on the death rates of the Union army in the Civil War, the German army in the Franco-Prussian war, the British army in the Anglo-Boer war, and the Japanese army in the Russo-Japanese war, Edward Bunnell Phelps, editor of the *American Underwriter*, says that the loss by death in the present war will be 540,000 if the average number of men engaged during the year amounts to 6,000,000, which is something more than the total annual death rate for the entire adult male population of the United States. But this does not prove that the life of a soldier is much more uncertain than that of a civilian under certain conditions. Thus Mr. Phelps finds from the American Experience Table of Mortality that a soldier's chances of living through a year of the war are greater than those of a civilian for living from the age of 25 to the age of 36, from 30 to 41, from 35 to 45, from 40 to 49, from 45 to 52, from 50 to 56, from 55 to 60, or from 60 to 63 years.

War has Lost Its Luster.—In spite of the enthusiastic descriptions written by correspondents far from the scene of action, the fact is that war has lost its luster, and the spectacular side of war has been abolished by the changes of time; in fact, war has become stupid. As a writer in the *London Times* tells us: "The general no longer rides at the head of his legions, if indeed he ever rides at all. Far in the rear, almost out of sound-range of the guns, he directs, if we can call it directing, the movements of his armies. Near by in some field the masts for the wireless; in every direction airlines and cables; in some inner room, poring over the map set out by the operations branch, the commander-in-chief, endeavoring to piece together news and to make things as unpleasant as he can for his distant enemy. In the field, no more the clatter and jingle of the squadrons. Trenches and always trenches, and nothing showing above the surface of the ground. Day after day the butchery of the unknown by the unseen, and events decided by the greatest mass of projectiles hurled simultaneously in the general direction of the enemy." The thundering charge of infantry has become more ghastly than glorious, for in the face of a devastating fire by every description of weapon, and innumerable mines and entanglements, few of the attacking force survive, and the result, at least on the western front, is merely an advance of a few feet and the capture of a few hundred yards of trench in a line hundreds of miles in length.

Science

Work of the "Carnegie" in High Latitudes.—The non-magnetic ship "Carnegie," belonging to the Carnegie Institution's Department of Terrestrial Magnetism, spent last season cruising in high northern latitudes and is to make a longer cruise in 1915-1916 to high southern latitudes, viz., between the 50th and 75th parallels, which will take her far into the Antarctic. On her last trip she sailed from New York, June 8th, 1914, and traveled about 10,600 miles, touching at Hammerfest, Norway, reaching latitude 79 degrees 52 minutes northwest of Spitsbergen, thence proceeding to Iceland, and ultimately making magnetic surveys in Hudson Bay. She returned to New York in October.

Agricultural Alcohol.—Some years ago the U. S. Bureau of Plant Industry began an investigation of the problem of utilizing the waste and surplus products of American farms as a source for the manufacture of denatured alcohol. Dr. Edward Kremers, of the University of Wisconsin, was sent abroad as a special agent to study the development of this product, especially in Germany, and his report has just been published as Bulletin 182 of the U. S. Department of Agriculture. German agriculturists have devoted a great deal of attention to finding new industrial outlets for alcohol and to improving and popularizing existing outlets. Potatoes are the great source of alcohol. About 6,000 agricultural potato distilleries were in operation in Germany at the time of Dr. Kremers's investigations.

The Size of Seed as a Factor in Plant Production is the subject of a report by M. B. Cummings, of the Vermont agricultural experiment station, in which the author describes experiments in planting sweet peas and a number of garden vegetables. There is, on the whole, a decided advantage in using large and heavy seed. Thus sweet peas from such seed were earlier in blooming, bore more and finer blossoms, and were generally more thrifty. The results were not uniform for all the species tried; but all showed some effect of the size of seeds except garden peas, when harvested as green peas. When these peas were allowed to mature, large seed gave slightly better results than small seed. A subsidiary investigation related to the location of large and small seeds in the pods of peas and beans. In the latter, 49 per cent of the small seed were found to occur in the basal end, while only 18 per cent occurred in the middle of the pod. In garden peas the small seeds were almost always found at the ends of the pods.

The Journal of Agricultural Research, published by the U. S. Department of Agriculture, recently entered upon its third volume, and at the same time opened its columns to contributions from the agricultural experiment stations. This important publication was founded for the purpose of bringing together the more technical research papers prepared in the department. Such papers were previously issued in the "bulletin" series of the several bureaus and offices of the department, along with papers of a more practical character. The number of these series caused the more advanced scientific memoirs to be scattered through an immense literature, and tended to make them difficult of access. An analogous situation has heretofore existed in connection with the voluminous publications of the agricultural experiment stations, though in some states the more technical publications have recently been segregated in separate series of "research bulletins." Hence it has been decided to publish a single journal in which the product of the two principal agencies for agricultural research in this country —viz., the Department of Agriculture and the experiment stations—can be presented promptly to the world in a form suitable for preservation.

The Migration of Tuberculous Persons in the United States, and its effects upon the public health, has been the subject of elaborate investigations by the Public Health Service for nearly two years past, and the work has now been completed in several states, while it is still in progress in others. Studies made in southern California in 1913 and 1914 showed that 17.8 per cent of deaths from tuberculosis in that section occurred within one year after arrival in the State; indicating that many tuberculous persons leave their homes for health resorts under conditions that are clearly contra-indicated. Little or no evidence was obtainable to show that the migration of tuberculous persons has any decided bearing on the health of other travelers or of the employees of railways and other common carriers. One striking result of the investigation in southern California is that the presence of tuberculous persons who have migrated to this section has, as a rule, had a beneficial effect on the health and social and economic status of the various communities. Many communities in southern California have been built up by migrating consumptives, and important enterprises have been originated by them. The only communities in which the public health has suffered are those to which large numbers of far advanced and hopeless cases resort without adequate financial resources; such consumptives are generally more careless in their personal habits and necessarily reside in cheap rooming and boarding houses.

Automobile

British Cyclecar With Novel Points.—One of the latest "cyclecars" or "light cars" manufactured in Great Britain, possesses a number of unusual features, not found in any other automobile made. It has a 4-cylinder motor with both valves and spark plugs set horizontaliy into the cylinder heads; a full steel casting in the form of a pan, which forms the forward end of the chassis; a mechanical starter which works on the principle of a ratchet screw driver or drill, and a new type of cantilever spring which is said to possess unusual flexibility and resiliency.

Motor Trucks Dominate Automobile Exports.—Stories of huge exports of motor trucks for the warring nations, which appeared early last fall, are borne out, at least partially, by the export figures for the month of December, 1914, which show more than $3,000,000 worth of "commercial" motor vehicles shipped abroad. France took two thirds of this total and Great Britain the remaining third. Shipments to Russia are held up at present because of the impossibility of getting anything through the ring of ice which surrounds the North Russian ports.

2,500,000 Motor Cars in 1916.—That on January 1st, 1916, there will be two and one-half million automobiles in the United States, appears a somewhat wild prediction, when it is considered that there are only about 600,000 automobiles in the whole world, outside of this country. Figures collected from the various States of the Union show that on February 1st, 1915, the number of registered cars exceeded 1,900,000, and the growth in the last 13 months has been equal to not less than 600,000 per year. As the rate of increase during the individual months has been much greater toward the end of 1914 than in the early part of that year, it seems certain that fully 600,000 cars will be added between February 1st, and December 31st, 1915.

Radiators for Power Wagons.—Of the various types of radiator which are found suitable for power wagon use, the smooth tube type is used extensively on recent cars of French build. The two water holders of the radiator are connected across by flat tubes placed side by side so as to present the edges to the air current of the fan, or in other cases the radiator uses a great number of round tubes of very small section (0.2 inch). The first method is used in the Berliet wagon, while the Renault employs the latter. Among smooth-tube make-ups, the Goudard and Menneson merits special mention, and it was the type preferred for the Paris autobus, besides being in use on De Dion, Schneider, Delaugére, and other cars. An air fan is mounted inside a drum formed by a top and bottom water holder joined by circular tubing. Such tubing has five rows in width and the same number in thickness, that is, the part occupied by the tubing has a square section, with 25 tubes. The air fan is designed so as to draw in air on each side of the fan, and drive it out from the edge, and it thus passes through the set of tubes, which thus receive a strong draught. Hot water from the motor enters the top receptacle and after descending through the tubes it collects in the bottom holder and returns to the motor. One point about this type of radiator is that as the tubes are curved, they become stronger and chances of breakage are less. On the road, should a tube break, it is an easy matter to remove it and stop up the two holes left, and the radiator works as before. Gravity water cooling can be employed in this type without the air fan, as it will work well either way.

Motor Laundries at the Front.—The latest use to which the automobile has been put by the warring armies of Europe is that of a laundry for the field hospital corps. The laundry consists of four vehicles, the leading one being a very powerful motor truck on which is mounted a steam mangle, which is easily removable. The second vehicle in the train contains a complete steam plant with boiler, turbine, drying cabinet and disinfecting tank. The third truck carries the washing machine itself, centrifugal drying drums, pumps for hot and cold water and a condenser for steam when the ordinary water of the neighborhood is too hard to be used for washing. The fourth truck is loaded with soap, soda, coal, gasoline and tools. On the march all four trucks are coupled together, while at the points of the battleline, where the hospital has been erected, they are arranged in the shape of a horseshoe. The entire "laundry" can be covered by a large tent. When in use, the train requires the attention of twelve privates and one non-commissioned officer. The motor truck, as soon as the steam mangle is removed, is used to carry laundry to and from the hospital. Bloody linen is first thrown into the disinfecting tank and boiled with strong soda and creosote soap. The drying cabinet is for woolen wear which is difficult to wring dry in the mangle. The capacity of such a laundry is about 3,000 pounds of assorted dirty linen daily. It has proved a tremendous success at the field hospitals on the German side, and has greatly reduced the work of the sanitary corps, with far greater cleanliness and efficiency.

Tests of Armor and Projectiles

LEADING down from the turret of a battleship through the protective deck is a tube known as the ammunition tube, through which shells and powder for the turret guns are brought up from the magazine. As this is a vital artery in a fighting ship the tube should be proofed against the shells of the enemy. Herewith is a photograph of two steel ammunition tubes, the one at the left being of a special armored steel developed at the Hadfield Works, in Sheffield. The tubes are shown after having been attacked by an 8-inch capped armor-piercing shell fired at a velocity of 1,400 foot-seconds and developing a striking energy of 3,600 foot-tons. The Hadfield tube was neither perforated nor cracked, and the projectile that struck it was shattered without doing the shell any material damage. Had the shell been loaded with a high explosive filler it would have burst harmlessly outside the tube.

To the right, in the photograph, is an expensive, forged, hydraulic-pressed, oil-tempered, nickel-steel tube. When an 8-inch shell was fired at this tube it pierced the target, fragments of the shell passing through the tube. The tube was cracked, as the photograph shows, and as it was perforated the shell, which was not broken up by the impact, would have burst inside the tube had it been loaded with the customary high explosive filler.

On this page we also show a picture of a 12-inch armor-piercing projectile after undergoing the test of passing through 12 inches of Krupp steel. Note the spiral scoring on the surface of the shell showing its rotation.

A 12-inch shell after having passed through 12 inches of Krupp steel.

Nerves and the War

A GERMAN scientific periodical, *Die Umschau*, recently published an article by Dr. A. Eulenburg on the changes wrought by the war on the nervous system of the combatants and the non-combatants who are subjected to the usual anxieties attendant on war.

Dr. Eulenburg opens the article by stating that the most popular German army commander, the general in charge of the Russian campaign, who was created a field marshal a short time ago, and is presumably von Hindenburg, expressed the opinion in a recent interview that the war (against Russia) resolves itself into a question of "nerves," and as the Germans have the better nerves they eventually will win. While coinciding in this view, Dr. Eulenburg thinks it opportune at this time to examine and consider the effects which six months of war have thus far produced on the nervous system of the nation, considering both those in the field and those who remain at home. From all reports and from extensive personal observations embracing participation in a number of campaigns, Dr. Eulenburg is convinced that in healthy individuals, endowed with a normal nervous equipment and having the requisite resistance, the so-called war neuroses are not a factor to cause alarm. On the contrary he considers war with all its physical and psychical impressions and experiences as a powerful salutary medium, a purifying, hardening and rejuvenating remedy for nerves which have become enfeebled and sluggish during long years of peace. Neither the leaders of the army nor the rank and file have thus far shown the slightest signs of exhaustion or nervousness of any sort. In spite of all the hardships and terrors of warfare, the severe physical exertions and exposures, the rigorous life in the trenches, the troops have maintained their vitality splendidly as well as their courage and their good humor.

In view of these illuminating facts we may accept the conviction that a so-called war-psychosis in the sense of a pathological condition caused exclusively by the incidents of war does not exist. Whenever cases of war nervosity, of neurasthenia, or other psychoses develop, which happens not infrequently, they, with the exception of those resulting from severe wounds to the head or brain, may always be traced to a predisposed psychopathic constitution. In these cases of unstable nervous balance the impressions and terrors of war act as the exciting cause. Thus the cases which were frequently observed in the war between Russia and Japan and in the Balkan wars are explained in the same manner, and no evidence whatever has thus far been adduced that perfectly healthy individuals have ever suffered from nervous disturbances caused by the war itself.

The term war psychosis has been defined by Buschan as a form of cerebral neurasthenia accompanied at times by hysterical symptoms, delusions, and even complete insanity. It invariably develops in persons who are constitutionally predisposed. The clinical picture presents increased irritability, exhaustion and great mental depression. The prognosis in the majority of cases is favorable, recovery being gradual with a disappearance of symptoms.

Another form of psychosis known as fear neurosis is observed most frequently in recruits who have not yet seen service. Occasionally it is observed in those who have been in the field and are temporarily relieved or discharged for purposes of recovery. The patients suffer from sleeplessness, hysteria, an exaggerated sense of fear and terror which at times becomes unbearable and even drives the victims to suicide. Of course these cases are not suitable for service and must be removed at once. Neither an appeal to reason nor the employment of sedatives or narcotics seems to have the slightest effect upon them. Generally the only thing to do with these poor victims is to place them in suitable sanataria, where by time and the requisite care their shattered nervous system may be restored to normal.

Then there are cases in which the nervous disturbance takes the form of a mania or hypomania. These are characterized by great mental excitement, an increased bodily activity and an irresistible desire to talk or write. This condition may be overlooked at first, but when recognized demands prompt remedial measures for the good of the afflicted as well as the service.

Dr. Eulenburg insists that these morbid conditions are in no respect due to the effects of the war, but their cause must be looked for in long existing predisposition of the individual and in a psychopathic constitution. In other words in an enfeebled nervous system unable to bear the trying and strong impressions of the war.

Still more sad, however, is the condition of those men and women who are obliged to remain at home, who are condemned to patient endurance and anxious waiting, whose emotions are always on edge, whose nervous system is always under a strain, experiencing sorrow and happiness by turns, one moment depressed by grief, the next elated with joy; always wrestling with doubt, fear and uncertainty.

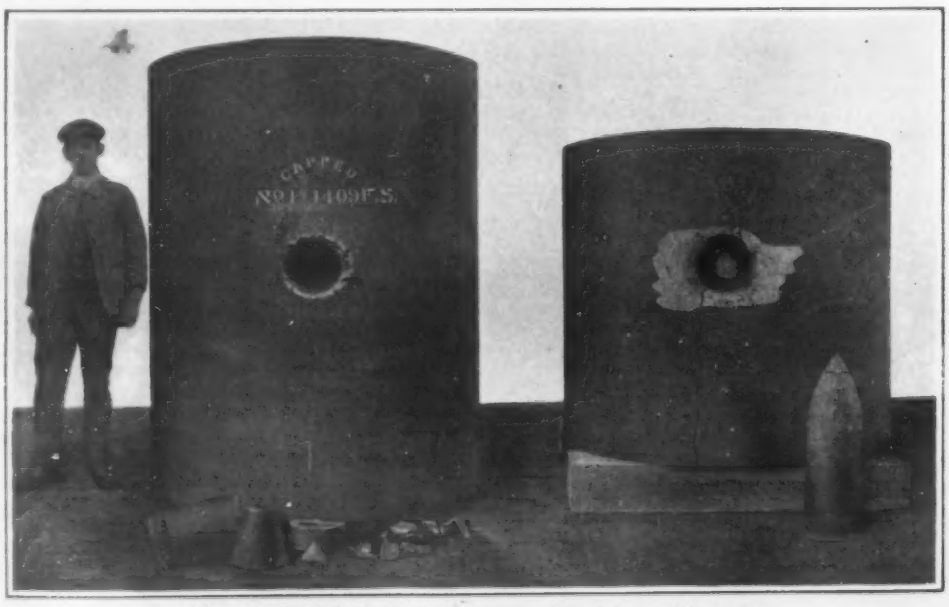
These depressing, nerve destroying emotions leave their impress permanently or otherwise according to the condition of the nervous system of the individual. Many succumb to the demons of doubt and despair.

This class furnishes the true martyrs of war, the real victims of war neuroses. They require our greatest sympathy and our most considerate care.

Whatever may be the experience of this war—and it is still too early to draw any conclusions—there was evidence enough gathered in our own civil war, that fierce battles produce nervous disorders. A hospital for neural disorders was created at Turner's Lane, near Philadelphia in August, 1862, and pavilions were built for four hundred men. It was in charge of the late Dr. S. Weir Mitchell, whose interest in nervous diseases was aroused while he was working as an army surgeon. In a fascinating address delivered before the Physicians' Club of Chicago on February 25th, 1913, in which he discussed the medical department of the civil war, Dr. Mitchell said:

"The cases were of amazing interest. Here (at Turner's Lane) were eighty epileptics, every kind of nerve wound, palsies, singular choreas, and stump disorders. I sometimes wonder how we stood it. If urgent calls took us back into town, we returned to the hospital as if drawn by a magnet. In fact, it was exciting in its constancy of novel interest. Thousands of pages of notes were taken. There were many operations, many consultations, and toward the close we planned the ultimate essays which were to record our work. Each of us took his share, but all three were mentioned on the title pages of our essays. There was a small book on nerve injuries and an essay on reflex palsies, both of which I wrote. Dr. Keen contributed an admirable paper on malingering. . . . Our notes on epilepsy were very full, and there were things recorded which I have never seen since or seen but once. . . . Our notes and conclusions in cases of acute exhaustion and extreme myasthenic conditions would have entirely anticipated the delineation of those orders which we now accept under the name of neurasthenia. . . . In this hospital massage was used to restore action to limbs in which healing nerve wounds left the muscles palsied, or for the rigidity of splintered cases.

"Among the numerous other matters . . . were the influence of nerve lesions on nutrition and temperature, the first record of wounds of the sympathetic nerve and the study of reflex palsies. The victims of nerve wounds were often men worn out from fever, dysentery and long marches; hence some of the symptoms of nerve wounds we described have never been seen since in like intensity. That hospital was, as one poor fellow said, a hell of pain. In one year over 40,000 injections of morphine were used. Time lacks here to re-describe cases of neuralgia of such intensity that the pain was increased by the vibrations of a band of music, by the rustle of dry paper handled, and by a loud footfall in the ward. I have seen men pour water into their boots to lessen the vibration which walking caused. I have never encountered such cases since."



Effect of 8-inch shells fired upon armored steel ammunition tubes.

Making Clothes for the German Army

A NUMBER of industrial works in Greater Berlin, mainly belonging to the metal, wood, leather, food, and clothes industries, are at present engaged on a large scale in the making of articles for war use. One of the accompanying views shows how a series of sewing machines, connected together by a nearly invisible common shaft and operated from the top by an electric motor fixed to the wall, are producing knapsacks and cartridge boxes out of ready-cut leather pieces. In another picture we see the manufacturing of pouches for field telegraphs. The material prepared beforehand is cut into shape on cutting machines and finished on punches, drilling machines, etc. The cutting of "field-gray" cloth for uniforms and cloaks is likewise done on electrically driven machines.

How Electricity Makes the Iron Cross

THE Iron Cross, a decoration created in 1813, at the time of the German Wars of Liberation, and revived in 1870, during the Franco-German War, is the most highly prized recognition of valor in the present conflict. While the decoration and the spirit animating those on whom it is conferred have remained the same as one hundred years ago, typically modern methods have been adopted in making the crosses. In fact, an extensive use is made of electrically operated machinery for the various stages of manufacture at the workshops intrusted by the German army authorities with producing the Iron Cross.

Iron Crosses are by no means produced by casting. Rectangular pieces of sheet iron stamped out with a punching machine are struck with steel dies on powerful presses, in accordance with the rules laid down by the Order Committee. One of our views shows two such coining presses in the foreground, each of which is provided with a big electric driving motor, while in the background is seen the punching machine, the motor of which is carried by a bracket on the ceiling.

After being thus prepared and tested, the Iron Crosses are taken to the silversmith's, where the soldering is done, a fine silver border added, and the finishing completed. A second illustration shows how the silver border surrounding the Iron Cross is polished on electrically driven polishing and grinding motors.

Clothing a Winter Army

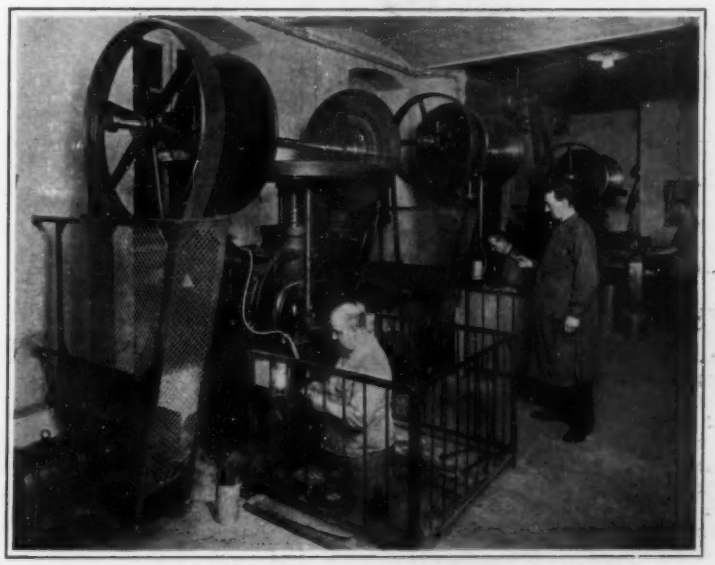
AS with everything else pertaining to an army, its clothing is primarily one of the duties of the General Staff. The watchfulness of nations against one another has resulted in an intimate knowledge of the number of men actually on duty, every arm adopted, each piece of new equipment, the resources of the country in every particular, and the probable mode of procedure to meet each hypothetical condition developed into actualities.

Naturally the *raison d'etre* of an army is defense, and defense means war; peace times are used in preparation for war, and in the days of peace the General Staff is engaged in working out each detail of possible war, reducing the results to paper, carefully checked and proved, and then filing them away against the time of need. War is planned on paper against every possible enemy; the duration of the war is carefully estimated, and in the estimate the seasons are considered and the comfort of the soldiers; for while the entire object of maintaining an army in the field is to get the most men available up on the line of battle, by far the greater work is to be found in caring for the men in the intervals between combats, that they may be in condition to fight when the time comes.

It is therefore perfectly safe to say that the present war which is devastating Europe has been fought out in more or less detail in the long days of study in days of peace. And in the fighting out, the problem of raising and maintaining stupendous armies has been worked out, the feeding of the armies, the supply and the clothing as well, with special regard to the chill ravages of winter in the field.

Electrically operated sewing machines for manufacturing knapsacks and cartridge boxes.

Cutting uniforms with an electrical knife.



How the Iron Cross is made with electrically driven punches and dies.

Polishing the silver borders of Iron Crosses on electrically driven polishing and grinding machines.

Take Germany, for instance. The German staff knew almost to a dot how many men could be turned out in defense of the empire. The staff knew almost the exact day when a certain number would be formed in the ranks; and in anticipation, clothing was ready for them, shoes, equipment and arms, stored away in warehouses where they could be brought to light with little or no confusion. Probably not five hundred persons in Germany outside the staff had ever seen the new field uniform of the German army until it was issued upon the tocsin call to arms last August; yet it was there.

Germany is, justly, accorded the highest and most complete military organization of any country which has ever been in existence. It may therefore be taken as standard, yet the other military nations, such as France, Russia, and Austria, are not far behind in completeness of preparation, and it is a fact that every resource has been computed for each eventuality. Consequently, long before war became more than an ever-present possibility, plans were completed in each country for clothing the soldiers, and with the declaration of war, the call to arms, the wheels of the clothing organization were set in motion, not to stop until the necessity for their grinding ceased.

Let us take a hypothetical country, declare a war and set the wheels to going. Utopia has declared war against a neighbor. Four million men will spring to arms, expanding from an army with a peace strength of 600,000. In anticipation, the staff has long ago caused the manufacture of 4,000,000 uniforms and equipments. As mobilization progresses, the storehouses are opened and over the railways, automatically brought under the direction of the military with the declaration, they are shipped to the various points.

The theater of war has long been known, as well as the probable duration of conflict. In accordance with the plans, based upon experience, observation of other countries at war, test, and always common sense, the staff well knows that the first equipment of clothing will not last over three months at the most of arduous service in the field, when one outer uniform is all that may be carried afield. The men have no change of uniforms; the marches take place alternately under burning sun, drenching rain or chill, and clouded day. Rivers are to be waded, breast high; mud-plastered trenches are to be occupied; grinding, cutting dust of a hot march is to be encountered, and the rough wear-and-tear of a campaign will surely reduce the material to a most thoroughly worn out condition in a short time. The shoes, most important articles to a soldier, receive constant wear; for they are seldom off the tired feet, and alternate wetting and drying play havoc with the leather.

The staff, then, knows that all this clothing must be replaced within three months. In addition, the reserve classes which are to be called to reinforcement must be clothed. Casualties will occur, and there must be fresh clothing to replace that so lost; although frequently the bodies of the dead are stripped, through necessity, and the clothing thus removed saved for issue to another new man, sometimes with a small bullet hole through the breast pocket and a dull stain around it. War does not make for squeamishness.

As the railways are seized upon war's outbreak, all the clothing factories of the land are assigned certain work to be performed. Either bids are called for or a just, flat price is fixed by the staff and a certain amount of work assigned to each house, willy-nilly.

Four million overcoats must be ready by the first of November, say. The houses which have the wool and other material

(Concluded on page 232.)

German Agriculture in War Time

By the Berlin Correspondent of the Scientific American

THE present war places before German agriculture a number of problems which it is confidently hoped will find a satisfactory solution. The dearth of hands will no doubt be met by recourse to female and volunteer labor, as well as by a temporary reflux of workmen from the cities into the country, so that there may not be any serious difficulty in this respect. Apart from this, there will, however, be a scarcity of certain commodities heretofore imported from abroad, of which German agriculture stands in urgent need for fertilizing the fields of the country, and these will have to be replaced by convenient substitutes.

Prof. Gerlach of the Emperor William Institute of Agriculture, Bromberg, Germany, has worked out some valuable suggestions for the manuring of the German fields in the absence of foreign fertilizers, which it seems will allow the present crisis to be met successfully. In order to appreciate the extent of the problem, it should be remembered that Germany in 1912 consumed 750,000 tons of Chili saltpeter, 425,000 tons of ammonium sulphate, 50,000 tons of lime nitrogen, and 50,000 tons of Norwegian saltpeter. To this is to be added the nitrogen contained in non-unglued bone meal, Peru guano and other nitrogenous fertilizers, the amount of which, however, remains far behind that held in the above materials.

Though the manufacture and use of ammonium sulphate, and even more that of lime nitrogen, have during the last two years undergone a considerable increase, Prof. Gerlach is of the opinion that half the nitrogen spread on the fields in the form of concentrated fertilizers is still Chili saltpeter. According to a conservative estimate, about 200,000 tons of nitrogen per annum would seem to be utilized in this way by German agriculture. When distributing this uniformly over the whole area of fields under cultivation a consumption of 7 to 8 kilogrammes per hectare is obtained, though present tendencies are toward a further increase of this amount. By far the greater part of the nitrogen, especially saltpeter nitrogen, is employed in the spring, from March to May. If, accordingly, the war should continue until next spring, the greater part of the indispensable nitrogen would be wanting. The German ammonia and lime nitrogen industry will doubtless endeavor to make up for the deficit, in which connection it will certainly be encouraged by the government. On the other hand, two to three times more saltpeter may be expected from Norway than in 1912, the manufacture of this product having in the meantime made great strides.

How indispensable is the use of soluble nitrogen compounds can be inferred from the following: One hundred kilogrammes of Chili saltpeter will enable the yield of rye fields to be increased by 400 to 500 kilogrammes per hectare. This corresponds to a total of 2,500 to 3,000 millions of kilogrammes for the total area of German rye fields (in 1912), viz., 6.14 millions of hectares. Similar results can be obtained by means of ammonia salts or lime nitrogen, and a similar calculation can be applied to the remaining cereals, to potatoes and turnips. In fact, nitrogen is the vegetable food exerting the most striking influence on the yield, and no other manure can be fully utilized if there is a deficit of efficient nitrogen compounds in the soil. On the other hand, there can be no doubt that those artificial nitrogen fertilizers at present in the market are very suitable substitutes for Chili saltpeter, Norwegian saltpeter, e. g., being absolutely equivalent to the natural product.

According to Dr. Gerlach's suggestions, the available amounts of Norwegian saltpeter should be used primarily as top manure for the rye next spring and for the beet-roots. For the rest, he recommends the following top manuring for the spring of 1915: Rye in rye soil proper, that is, in light loamy sand, should, in the spring, receive 20 to 30 kilogrammes of saltpeter nitrogen, as top manure, unless stable or green manure is used. The same applies to the dark alluvial soil of the lowlands. In case of a dearth of Chili or Norwegian saltpeter, Dr. Gerlach suggests substituting for the above quantity of nitrogen either ammonium sulphate (100 to 150 kilogrammes) or lime nitrogen (150 to 250 kilogrammes per hectare), both fertilizers being applied as early as possible in the spring. In the case of wheat, the dose of nitrogen can be frequently reduced, on account of the better soil and more satisfactory conditions, 15 kilogrammes per hectare (corresponding to 75 kilogrammes of ammonium sulphate and 100 kilogrammes of lime nitrogen, respectively) being mostly sufficient. The excellent effects exerted by saltpeter on the development of oats are well known. Ammonium sulphate has also in this case given good results, 150 kilogrammes per hectare being generally sufficient. Barley does not always require nitrogen fertilizing; in the case of middling ground, 75 kilogrammes of ammonium sulphate or 100 to 150 kilogrammes of lime nitrogen will be sufficient.

Stable manure should preferably be reserved for potatoes. In case of an abundant use of animal manure (200 to 300 kilogrammes per hectare) no special nitrogen fertilizers will, as a rule, be required. Beet-roots, however, even in animal manure, cannot dispense with nitrogen fertilizers, 300 to 400 kilogrammes of Chili saltpeter or the corresponding amounts of artificial fertilizer being generally used.

Should it be absolutely impossible to provide the necessary amounts of nitrogen fertilizer by next spring, a reduction will, of course, have to be made. This, however, should, as far as possible, be avoided with rye in light soil, where nitrogen fertilizing is the most indispensable and cannot be made up for later on. A deficit of bread corn would also be felt most keenly by the German people.

On account of the great importance of artificial nitrogen fertilizers destined to serve as substitutes for Chili saltpeter, both the government and private parties will promote their production. Should there, however, be no possibility of making up for the deficit, there would, of course, be a reduction in the yield of cereals, but the country would not by any means be brought to the verge of starvation. In fact, Dr. Gerlach estimates the deficit of corn, in the worst possible case, that is, if there should not be even a partial compensation, at about 1,000,000 tons, viz., barely 4 per cent of the total crops. It is true that, on account of the partial or total cessation of imports, even this deficit would be keenly felt.

As regards the question of potash fertilizing, German agriculturists need not entertain any fear, the production of potash salts continuing undisturbed. Even in the event of there being a deficit of nitrogen the amount of potash fertilizers should not be reduced, these materials being relatively cheap, while any potash not absorbed mostly remains in the soil.

Whether German industry will be able to provide the full amount of phosphorus fertilizer needed by the country cannot yet be said. The production of Thomas meal continues, and since the German iron works are kept very busy considerable quantities of this valuable fertilizer will be brought on the market. On the other hand, it is doubtful whether sufficient amounts of crude phosphates and pyrites for the manufacture of superphosphates may be available, the larger part of these materials having so far been imported from the United States, Algeria, Belgium, Portugal, and Spain. In the event of a deficit the use of these manures would, of course, have to be reduced, which in many cases could be done without any inconvenience.

The Prussian government has granted individual agriculturists and agricultural societies considerable loans for the erection of potato drying plants, of which a large number are already in course of construction. Two hundred new installations are to be added to those so far in operation, so that the greater part, if not the whole, of the potatoes left unused during the winter may be dried. Three products will be marketed, viz., potato flakes, potato shavings and compressed potatoes, all of which constitute excellent, durable and handy fodder. The digestibility of these products is not altered by the drying process and actual tests have shown each of them to be utilized to the same extent. Their nutritive qualities can be even increased by soaking them in skimmed milk, whey, or water.

Germany's Nitrate Supply

A FRENCH Senator, in calling attention to the probable diminution in agricultural crops, in Germany and Austria, caused by the cessation of the imports of Chili saltpeter, amounting to 750,000 tons annually, recently asked how the supply of explosives would be affected. A writer in *Le Temps* gives the following conjectural answer:

It is probably not far from the truth to estimate the consumption of explosives, by each group of belligerents, at 400 tons per day, or 150,000 tons per year. In practice from three to ten tons of nitric acid are used in making one ton of explosive. Assuming five as the average proportion, we arrive at an annual consumption of 750,000 tons of nitric acid.

The available sources of supply are the following: In Bavaria, and at Innsbruck, in the Austrian Tyrol, are two factories which produce nitric acid from the atmosphere. Their combined power is 65,000 horsepower, which, if completely utilized, would produce 30,000 tons of nitric acid per year. A factory in Westphalia annually produces 1,500 tons of nitric acid by the Ostwald process, in which the ammonia evolved by coke ovens is oxidized in presence of platinum. This interesting method has probably attracted the attention of German chemists, especially in present conditions which make the cost of the product relatively unimportant. The production of nitric acid in this way may have been increased tenfold since the war began, but it cannot have been increased a hundredfold.

The French bacteriological method of Muntz and Lainé, which consists in sowing great beds with nitrifying bacteria, is capable of yielding 500 tons of nitric acid per hectare (2½ acres), but several months elapse before the beds begin to produce regularly, and the yield is greatly diminished in winter. Hence, this method is not likely to be employed.

The total annual supply of nitric acid obtainable from the domestic sources enumerated above may amount to 50,000 tons, or one fifteenth of the consumption. The deficiency would not be supplied even if all of the nitric acid produced in Norway by the Birkeland process, about 400,000 tons per year, should pass into the hands of Germany and Austria—a very unlikely supposition.

This is a French view of the situation. We have more confidence in the ingenuity of the German chemist to meet the requirements of the situation.

Forging the Inner Tube of a German 16½-inch Siege Gun

THE ability of the Krupp works to turn out 16½-inch siege guns possessing a certain limited amount of mobility, is due partly to the undoubted skill of the designing department and even more to the great advances which have been made of late years in the art of gun-steel manufacture. The prime consideration in building a 16-inch siege gun for field operation was to reduce the weight to the lowest point compatible with the requisite strength. The Germans have not given out any details regarding this piece; but this much is certain, that in order to make such a gun practicable, it was necessary to employ low pressure in the powder chamber and to make the gun barrel of a special quality of steel, embodying great tensile strength in proportion to its weight. Probably the barrel is forged from one of the new steel alloys from which such remarkable results have been obtained in the various arts, and particularly in gun manufacture. Our own Lieut. Cleland Davis used for the barrel of his torpedo gun a vanadium-steel alloy, from which he obtained excellent results. Possibly the Germans are using an alloy of this or kindred character for the 16-inch siege gun.

The production of gun-steel is a long and tedious and costly process and calls for the greatest care in making up the composition of the steel, in casting it, and in forging the ingot to the required rough shape ready for the lathe.

It is a prime requisite in gun steel that it shall be perfectly homogeneous throughout. Also it must be absolutely free from irregularities due to segregated material, incipient flaws, seams, etc. These qualities are secured largely in the process of forging, and in order to obtain that thorough working of the material which conduces so greatly to its toughness and strength, it has long been the practice to forge the gun barrel upon a central mandrel which is inserted in an axial hole through the forging, when it is brought white-hot from the furnace and placed in the hydraulic press as shown in our illustration. The material is squeezed between the mandrel and the press, the ingot being given a slight turn between each squeezing, by means of a chain which passes around the forging and is operated by the gears shown in the upper bight of the chain. Gradually the piece is reduced in diameter and drawn out to proper length, until the desired final size of the rough gun barrel is reached.

The Current Supplement

THE leading article in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2044, for March 6th, is a most valuable paper by Dr. George M. Gould on A System of Personal Biographical Examinations the Condition of Adequate Medical and Scientific Conduct of Life, that will be found of interest not only by the layman, but especially so by the medical profession, as it discusses one of the most vulnerable features of medical practice. The account of the experiments in registering radio time signals with a physiological recorder gives an interesting account of the application of frog dissections for detecting slight impulses. Reproductions of the records are given and illustrations of the apparatus. Experiments with Flying Boat Hulls gives some of the results secured in experiments made in the model basin at the Washington Navy Yard. Snag Boats on Flood Rivers tells how snags get into rivers and the methods adopted by the Government to remove them. Several instructive illustrations accompany the article. Electroculture of the Soil is a valuable discussion of a topic that is attracting wide attention, as it deals with the electrical processes in biological reactions. The illustrated description of the hydraulic mining cartridge and its various applications and the results obtained tells of a very efficient mechanical device for breaking down minerals where it would be dangerous to use explosives. A timely article is a report of the Committee on Resolutions of the Snow Removal Conference, held at Philadelphia in April, 1914. This is a subject of interest to the citizens of every city in the country within the snow belt. Other articles are German System and Method, telling what their industries are doing since the war began; Electric Waves and Oscillations as a Means of Investigating the Interior of the Earth; Diseases Dangerous at Different Periods of Life, and a number of shorter articles.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Congress and National Defense

To the Editor of the SCIENTIFIC AMERICAN:

Let me congratulate you on your "War Issue No. 5," dealing with "Our National Defenses."

The conditions responsible for the present state of our national defenses are, to my mind, ably set forth.

I, for one, trust the day is not far distant when all of the various creeks will have received their necessary appropriations, when all of the squash centers will have their public buildings, and our Congress will feel that they have the time and the means to pay a little attention to the most vital matter of our national welfare.

Neche, N. D. FRED. L. LEWIS.

Comparative Fighting Value of Fighting Ships

To the Editor of the SCIENTIFIC AMERICAN:

I do not think Mr. A. Given's system of calculating the fighting value of battleships is correct. Details of the principal ships he mentions are as follows:

Name	Tonnage	Speed	Guns Ins.	Broad-side	Belt Ins.	Units
"Iron Duke".	25.400	22	10—13½	10	12	3,426
"Kaiser"	24.700	23½	10—12	10	14	3,088
"V. Unitis"..	21.370	20.8	12—12	12	11	3,118
"Jean Bart".	23.470	21.7	12—12	10	10¾	3,780

Moreover, the "Kaiser," being laid down in 1909, is by no means the latest German battleship. Also, the "Jean Bart" carries 12-inch guns, and not 13½-inch, as stated in your war issue of September 5th, 1914.

From the above it will not be difficult to see that the fighting value of these ships is in the order named, with the "Kaiser" running a close second to the "Iron Duke." With her *complete* belt of 14 inches, no doubt quite a few would bet on the "Kaiser" to be the best ship in the lot, also on account of her superior speed.

San Francisco, Cal. CHARLES VORNHOLT.

Long-range Guns in Forts

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 26th, 1914, there appeared an article by Adrian Getaz, "Some Suggestions About the War."

He believes that if a fortress should have larger and longer ranged guns than its attacker that fortress would not fall. This would be so if every bit of ground within range was visible to the garrison of the fortress. But with ranges of ten and fifteen miles this is no longer possible.

The lighter movable guns are moved by night to invisible positions. The exact location of the fortress and most of the details are known through spies before the war began. The fall of the shots is observed, while the fortress strikes blindly.

If the fortress is surrounded by a friendly army strong enough to hold or win all points of observation within range, then the long-range fortress guns can give that army great support if it is attacked. If that army is driven away or driven into the fortress and is unable to make sorties, that fortress will fall, no matter how many long-range guns it may have, if it is attacked by modern, efficient, heavy artillery.

New York city. F. A. DE PEYSTER.

Suggestions for a Reserve Army

To the Editor of the SCIENTIFIC AMERICAN:

Your articles on the defenselessness of the United States and our inadequate army touches on a theme dear to my heart, and tempts me to offer a suggestion, as the subject of an article for your able pen.

It is only of recent date that army regulations have made it possible for the United States to build up a reserve force from the ranks of discharged soldiers; but unfortunately this reserve cannot be formed until the men now serving enlistments are discharged.

There are many thousands of ex-soldiers in the various parts of the country over whom the Government has lost its jurisdiction, but who would be a valuable addition to our standing army. It is true they cannot be compelled to act as reserves, yet there are many among them who would voluntarily place themselves on the reserve list, if the Government prepared one and made the appeal.

Many of these men, if not all, are proud of their service; and would gladly be still connected with the service; but object to being compelled to follow another period of routine, such as militia service, etc.

There are those who will say it is superfluous, that these men would be available in war time anyway; quite so, but they would be widely scattered among the untrained volunteers, and it would be impossible to separate the chaff from the wheat. On the other hand, with these trained ex-soldiers on a reserve list, they could be immediately mustered into a separate body, and be available as trained troops, where otherwise they would be lost among the raw levies.

How could these men be kept track of? And of what would their obligation consist?

An applicant may have served at least one year in the regular army, or three years in the militia, be under thirty-five years of age when enrolling; take the same oath as administered in regular enlistments and be bound thereby; and to keep informed the department under whose jurisdiction he is placed of changes in address; or in the event of leaving one district obtain a transfer to another. Reservists should be compelled to attend maneuvers for one week each year, being supplied with a uniform by the Government at the time of enrolling.

The yearly attendance at maneuvers to be the only requirement of the reserves, it would be looked upon as a vacation rather than a duty. They to be called to the colors only in case of war.

There may be other policies suggested, but I think none could be brought into effect quicker, or with less expense, if the Government could be induced to make the experiment.

I trust you may be able to use this theme as a means of radiating enthusiasm into the powers that be through an article in your columns.

Chicago, Ill. V. H. BIELEFELD.

Who Invented the Periscope?

To the Editor of the SCIENTIFIC AMERICAN:

It is stated by some writers that the periscope, the eye of the submarine, was invented by the French. The first device of this kind to be used in naval warfare was invented by Thomas Doughty in 1864. He was at that time acting chief engineer in the U. S. Navy. During Banks's Red River expedition Doughty was on the turreted monitor "Osage." The gunboats were annoyed by bushwhackers and Confederate cavalry picking off their men. Doughty rigged up a sheet iron tube extending from a few feet above the deck to the engine room below, with openings near the top and bottom, and by arrangement of mirrors he could see on shore. When attacked, he would signal the gunners to turn loose, and the enemy soon learned to give the "Osage" a wide berth. He little realized that his invention would be utilized in the world's greatest war. On the "Indianola" Doughty ran the batteries at Vicksburg, and his vessel was sunk in the fight near Grand Gulf and he was captured. After his exchange he was assigned to the "Osage," which was blockading the mouth of the Red River. While on this duty he took twenty men and captured two large Confederate transports, for which he was complimented by Admiral Porter. He distinguished himself in the Red River expedition and subsequently at Mobile. He was one of the old-time, resourceful engineers of the Mississippi River, and after the war he resumed his profession. He died in St. Louis in 1896. W. R. HODGES.

St. Louis, Mo.

Disabling a Locomotive

To the Editor of the SCIENTIFIC AMERICAN:

The paragraph on page 519 of the issue of Dec. 26th, 1914, regarding the best way of disabling a steam automobile, brings to the writer's mind the rather elegant way of putting a locomotive quickly and permanently out of commission, used in the civil war. The steam chest covers were removed and the bridges between the ports in the slide valve seats were smashed out, and the covers carefully replaced, so that from all appearances nothing had been tampered with. The enemy, after firing up, was pleasantly surprised when all the steam chose to go directly up the stack and not pay a visit to the cylinders *en route*.

The writer has seen a number of war pictures showing the efforts of the retreating Belgians to wreck the railroad lines. In each case the ballast had been removed from under the track, leaving the ties and rails intact. With a few jacks and a gang of shovelers the line could be brought up to a fair grade about as quickly as it had been wrecked. Sherman's "bummers" did a more thorough job by tearing up the rails, heating them white hot in fires built of the ties, and wrapping them artistically around the neighboring telegraph poles and tree trunks. HERBERT FREEMAN.

Newark, N. J.

Congress and Our Military Defenselessness

To the Editor of the SCIENTIFIC AMERICAN:

Why, in view of the disinterested stupidity of our present Washington representatives, would it not be possible to form what might be called a "National Defense Society"—taxing each member a possible and extreme yearly charge of $5, and providing a suitable badge if thought desirable?

The understanding being that the money thus derived be used for defense purposes under a competent board.

From $50,000,000 to $100,000,000 could be raised.

A reasonable yearly wage might be paid to a "Citizen Militia," providing rifles, ammunition, air-craft, etc.

I cannot express my indignation at the want of common sense being shown in Washington, and I believe if your valuable publication were to present some such proposition, you would be agreeably surprised at its instant popularity.

The average true citizen of the United States is most patriotic, and I have thus far failed to talk with any one who is not disgusted at the ignorance and apathy being shown by those whose duty it certainly is to see that we are properly protected.

As conditions now are we are humiliated by our weakness.

Through the incompetence of our present Administration, the citizens of the United States are being taxed and doubly taxed with a certain prospect of a deficit of some $40,000,000, yet our most respected and highly educated President is pressing an additional expense of $30,000,000 for an unlawful purpose, which not only renders us liable to serious and almost certain international complications, but increases the deficit, and which the people of this country must pay whether they will or not.

If you will give this matter your serious attention, although I am fully aware of the crudeness of my suggestion, you will greatly oblige a subscriber of long standing. BOSTON.

P. S.—The writer has lived abroad a number of years, and has a more than ordinary knowledge of naval matters, and he finds your War Issues as published to date wonderfully instructive.

[There is at present a National Security League, with headquarters at 25 Pine Street, New York, which is engaged in laying the facts as to our military defenselessness before the country and making Congressmen pay heed to its naval and military advisers.—EDITOR.]

How Lieut. Gerstner Perished

To the Editor of the SCIENTIFIC AMERICAN:

I beg to invite your attention to the paragraph headed "Army Aviator Perishes," page 79, your volume cxii, No. 4, of January 23rd, 1915. Lieut. Gerstner was uninjured upon reaching the water, as was the machine practically.

Capt. Muller, in his testimony before the Board of Officers which investigated the accident, stated in part as follows:

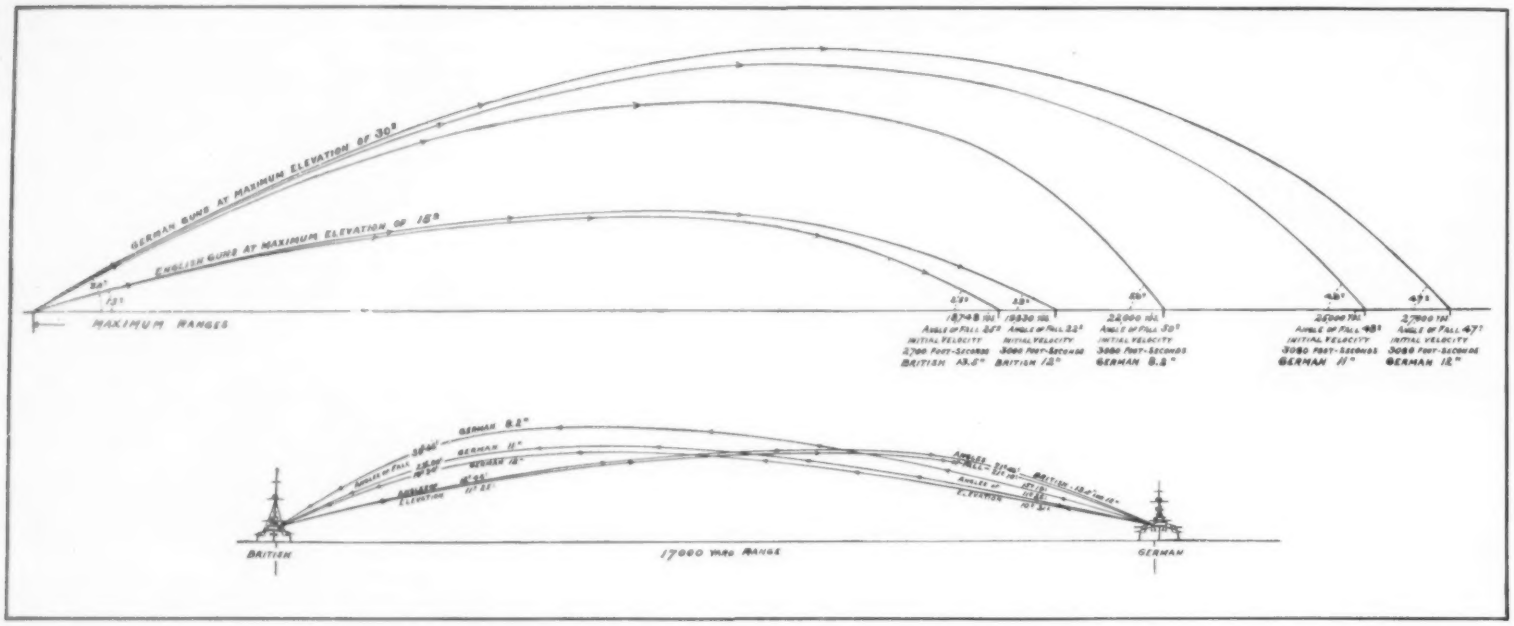
"She was then coming almost vertically downward, sliding to the left. I seemed to pull her up slightly, and when about 500 feet from the water, unable to handle my power in any way, I cut the switch. I felt full control of the machine when about 50 to 100 feet over the water. I made a normal landing on the water, but could not head into shore, as I had to use all my speed trying to slide the ship sidewise into the wind. The ship landed undamaged except for a few wires in the wing section which were streaming in the wind. The machine as it came to a stop went down by the nose. Lieut. Gerstner was under water. I pulled him up to the rear seat and we got out, standing on the running gear. I couldn't distinguish any bottom. We examined the shore line. Only two houses were in sight. No signs of life were visible. We examined the machine, trying to remove some parts that would float us in, especially the flaps. Required tools. Endeavored to secure the tool kit. It was under water about four feet. I dived for it several times, located it, but it was wired so tightly that I could not release it. Gerstner and I then helped each other undress. I don't recall whether he took off his flannel shirt or not, as I advised him to keep some wool on his body. I had a wool union suit on. We examined the machine very carefully by swimming around it during this time and found all controls intact—surfaces, hinges, and wires. We then discussed plans for getting relief. Gerstner favored swimming ashore. We were about a half mile out when we landed. I favored sticking to the ship until it was reasonably certain that no boat would put out from shore. Gerstner insisted that one of us ought to go ashore, and I offered either to go myself or to draw lots with him. I told him that I didn't believe either one of us could make it. He claimed that he was an experienced swimmer; that many times he had swum two or three miles. I had no knowledge of his ability to swim, and thought he was trying to encourage me. I accordingly had no faith in his ability to swim, and remonstrated for a long time with him. After we had been in the water what seemed a long time, Lieut. Gerstner said he was going ashore, and he asked me what I wanted him to do when he got there. I said, 'If you are going ashore, you had better notify San Diego and Los Angeles to get out fast motorboats and, if possible, save us, because I don't think the machine will float an hour longer at the most.' Gerstner left, but when he was about forty or fifty feet out I felt it was impossible and called him back, telling him so. I had a cramp at that time, and I asked him how he felt. He said he felt good enough to make the shore if he went then, before we got any farther out to sea. Shortly after, he started the second time and got about a half mile when he disappeared, and then shortly after that the ship was going pretty low and I started to swim myself, but when I got out a short distance I realized that I couldn't make it and put back. Then I tied myself to the elevator wires and waited. Finally a boat picked me up."

It is to be observed that the lamentable death of Lieut. Gerstner was caused by the attempt to swim ashore and might have been due to any accident of the sea. Such a paragraph as that in your issue of January 23rd has a tendency to create a wrong impression in the minds of the public and has an injurious reflex on the aviation service of the Army.

GEORGE P. SCRIVEN,
Brigadier General, Chief Signal Officer of the Army.
Washington, D. C.

Hitting an Invisible Ship at a Ten-mile Range

How the Greater Elevation of the Lighter German Guns Enables Them to Outrange the Enemy



Data for maximum possible elevation, 30-degree German, 15-degree English.

BRITISH 13.5" GUN. Fifteen Degrees.	BRITISH 12" GUN. Fifteen Degrees.	GERMAN 12" GUN. Thirty Degrees.	GERMAN 11" GUN. Thirty Degrees.	GERMAN 8.2" GUN. Thirty Degrees.
Initial velocity, 2,700 f.s.	Initial velocity, 3,000 f.s.	Initial velocity, 3,080 f.s.	Initial velocity, 3,080 f.s.	Initial velocity, 3,080 f.s.
Weight of projectile, 1,250 lb.	Weight of projectile, 850 lb.	Weight of projectile, 860 lb.	Weight of projectile, 660 lb.	Weight of projectile, 275 lb.
Angle of elevation, 15°.	Angle of elevation, 15°.	Angle of elevation, 30°.	Angle of elevation, 30°.	Angle of elevation, 30°.
Range, 18,748 yds.	Range, 19,830 yds.	Range, 27,500 yds.	Range, 25,900 yds.	Range, 22,000 yds.
Angle of fall, 25°.	Angle of fall, 22°.	Angle of fall, 47°.	Angle of fall, 48°.	Angle of fall, 50°.

Data for 17,000-yard range.

BRITISH 13.5" GUN.	BRITISH 12" GUN.	GERMAN 12" GUN.	GERMAN 11" GUN.	GERMAN 8.2" GUN.
Initial velocity, 2,700 f.s.	Initial velocity, 3,000 f.s.	Initial velocity, 3,080 f.s.	Initial velocity, 3,080 f.s.	Initial velocity, 3,080 f.s.
Weight of projectile, 1,250 lb.	Weight of projectile, 850 lb.	Weight of projectile, 860 lb.	Weight of projectile, 660 lb.	Weight of projectile, 275 lb.
Range, 17,000 yds.	Range, 17,000 yds.	Range, 17,000 yds.	Range, 17,000 yds.	Range, 17,000 yds.
Angle of elevation, 12° 44'.	Angle of elevation, 11° 25'.	Angle of elevation, 10° 31'.	Angle of elevation, 11° 25'.	Angle of elevation, 15° 19'.
Angle of fall, 21° 43'.	Angle of fall, 21° 10'.	Angle of fall, 19° 34'.	Angle of fall, 22°.	Angle of fall, 30° 46'.
Striking energy, 12,806 ft. tons.	Striking energy, 8,353 ft. tons.	Striking energy, 8,890 ft. tons.	Striking energy, 6,196 ft. tons.	Striking energy, 2,115 ft. tons.

ONE of the surprises of the present naval war is the extraordinary ranges at which the engagements between ships carrying armor-piercing guns are being fought. In the action between Von Spee and Cradock off the coast of Chile, the first 8.2-inch salvos of the "Scharnhorst" and "Gneisenau" landed on the "Good Hope" with telling effect at 12,000 yards. In the engagement off the Falkland Islands, the earlier stages of the running fight were fought at 15,000 yards range. Later in the battle-cruiser engagement in the North Sea, Admiral Beatty in his official dispatch stated that he began to land on the enemy at 17,000 yards, or say ten miles; and later descriptions of the fight by those engaged stated that the range never fell below seven miles.

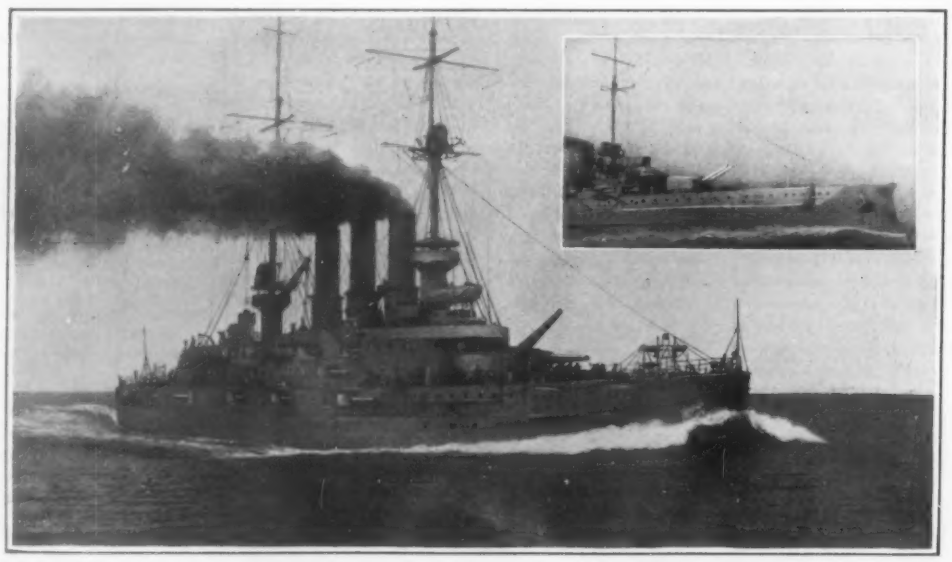
The question has been raised as to whether the lighter German guns were able to reach the British battle-cruisers during the earlier stages of the fight when the 13.5-inch shells were getting home. This is a decidedly interesting point, and with a view to presenting the actual conditions, we publish the accompanying photographs and diagrams, which show that not only the 12- and 11-inch, but also the 8.2-inch guns of the German battle-cruisers and armored cruiser were able not only to reach, but to outrange the British ships, and also that their penetrative power was theoretically sufficient for them to have done deadly execution.

It should be explained that the data regarding these guns, both British and German, are taken from the published commercial tables of Vickers-Maxim, Armstrong, and Krupp. With the exception of the British 13.5-inch guns, whose initial velocity is 2,700 feet per second, the velocities given are very high for guns of large caliber. They are perfectly possible; but because of the intense heat of combustion of the large powder charges necessary to secure these velocities, the erosion is presumably very high, and the accuracy-life of such guns is limited. The Krupp people claim to have mastered the problem of erosion; but whether by use of a special steel for the inner tube or by the quality of their powder, or both, they do not state. We do know that one of the leading naval powers not long ago made an offer to give the Krupp firm a contract to provide all of their heavy guns, provided a guarantee was given that, using these high velocities, the guns would have an accuracy-life of 250 rounds. The offer was refused. As regards the British guns of Vickers-Maxim and Armstrong, it is known that erosion is severe; but the British claim that they can reline their eroded guns so quickly, and at a cost so moderate, that they prefer to use high velocities, because of the great advantages of accuracy and hitting power at long ranges conferred thereby.

It will be noted from the diagrams that the British guns are credited with a maximum elevation of 15 degrees. That is the maximum for the main batteries in our own navy, and we believe the same practice is followed by the British. The motive for setting this limit is the fact that at 15 degrees elevation, when the ship is on an even keel, the shells will carry to a far greater distance than can be covered by the average sighting conditions on the high seas. The German Admiralty, however, with wise prevision, as it seems to us, have given to their heavy batteries a maximum elevation which is at least twice that of the British guns, namely, 30 degrees, or possibly more.

We present illustrations of two of their ships, the battleship "Schlesien," carrying 11-inch guns in its main battery, and the ill-fated "Bluecher," which mounted the 8.2-inch gun. In each photograph these pieces are shown swung up to full elevation, which apparently is slightly over 30 degrees. Now, referring to the diagram showing the trajectory of the shells at the 17,000 yards or ten-mile range at which the British first began to land on the Germans, we find that, if the velocities given are correct, the 8.2-inch guns of the "Bluecher," with an elevation of 15 degrees and 19 minutes, would have fallen on the British cruisers at an angle of 30 degrees and 46 minutes; that the 11-inch guns of the "Seydlitz" and "Moltke," firing at 11 degress 25 minutes elevation, landed their shells upon the British at an angle of 22 degrees, and that the 12-inch guns of the "Derfflinger," elevated to 10 degress and 31 minutes, would have hit the British ships at an angle of 19 degrees and 24 minutes. This last, it will be observed, is a flatter trajectory than that of the British 12-inch and 13.5-inch guns, the angle of fall of these being, respectively, 21 degrees 10 minutes and 21 degrees 43 minutes.

The diagram showing the curves of flight and the extreme ranges at the maximum possible elevation of the various guns, brings out the surprising fact that the 8.2-inch guns of the "Bluecher" were



German battleship "Schlesien" and armored cruiser "Bluecher," showing high elevation of guns.

capable of throwing their shells to an extreme range of 22,000 yards, or over 3,000 yards farther than the British 13.5-inch guns. The greatest range is that of the German 50-caliber 12-inch, which can throw its shell to a distance of 15½ miles; the German 11-inch can cover 14¾ miles; the German 8.2-inch, 12½ miles; the British 12-inch, 11½ miles; and the British 13.5-inch guns about 10 2/3 miles. It will be noted that the British 13.5-inch is outranged by the British 12-inch; which is to be accounted for by the fact that its initial velocity is 300 feet per second less.

The predisposing motive of the Germans in giving such high maximum elevation to their guns was to enable them to reach the enemy after their own ships, due to injury at the water line, had a heavy list toward the enemy. It is evident that the "Derfflinger," for instance, might be listed 15 degrees toward the enemy and still have 15 degrees of elevation available for long-range fighting. This wise provision has rendered it possible even for the lighter armor-piercing guns of the Germans to land upon the British at the great fighting ranges selected by the latter. It was the greater striking energy of the 13.5-inch gun and its much heavier bursting charge, coupled with better shooting and better engine-room equipment and operation, that enabled the British battle-cruisers to win the North Sea fight.

The striking energy of the projectiles at 10-mile range are: German 8-inch, 2,115-foot-tons; German 11-inch, 6,196 foot-tons; German 12-inch, 6,890 foot-tons, and British 12-inch, 8,353 foot-tons; British 13.5-inch, 12,806 foot-tons, or about 50 per cent more than that of the 12-inch gun.

When the British battle-cruisers began to land on the "Bluecher," her hull was invisible. Only by the fire control officers a hundred feet above the deck could her whole hull be seen. Similarly, when the 13.5-inch shells began to fall "out of the blue" upon the "Bluecher," the gunners in her turrets did not see the hull of the ship from which the projectiles came.

Among the many accounts given by participants in the North Sea fight, by far the most dramatic and instructive is that given by German survivors from the "Bluecher" and published in the *London Times* and *Sphere*, from which we take the following description:

"The British ships were away on the horizon, some 15 or 16 kilometers distant, when they started to fire. Shots came slowly at first. They fell ahead and over, raising vast columns of water; now they fell astern and short. The British guns were finding the range. Those deadly water spouts crept nearer and nearer. The men on deck watched them with a strange fascination. Soon one pitched close to the ship, and a vast watery pillar, a hundred meters high one of them affirmed, fell lashing on the deck. The range had been found. *Dann aber ging's los!* Now the shells came thick and fast with a horrible droning hum. At once they did terrible execution. The electric plant was soon destroyed, and the ship plunged in a darkness that could be felt. 'You could not see your hand before your nose,' said one. Down below decks there was horror and confusion, mingled with gasping shouts and moans as the shells plunged through the decks. It was only later, when the range shortened, that their trajectory flattened and they tore holes in the ship's sides and raked her decks. At first they came dropping from the sky." This observation is of particular interest; the diagram given on the adjoining page explains to what a great height the shells must have risen before they began falling toward the"Bluecher's" decks.

"The shells penetrated the decks," continues the *Times* narrator. "They bored their way even to the stokehold. The coal in the bunkers was set on fire. Since the bunkers were half empty the fire burned merrily. In the engine-room a shell licked up the oil and sprayed it around in flames of blue and green, scarring its victims and blazing where it fell. Men huddled together in dark compartments, but the shells sought them out and there Death had a rich harvest. The terrific air pressure resulting from explosion in a confined space left a deep impression on the minds of the men of the 'Bluecher.' The air, it would seem, roars through every opening and tears its way through every weak spot. All loose or insecure fittings are transformed into moving instruments of destruction. Open doors bang to—and jamb—and closed iron doors bend outward like tinplates, and through it all the bodies of men are whirled about like dead leaves in a winter blast, to be battered to death against the iron walls. In one of the engine-rooms—it was the room where the high-velocity engines for ventilation and forced draughts were at work—men were picked up by that terrible *Luftdruck* like the whirl-drift at a street corner and tossed to a horrible death amid the machinery. There were other horrors too fearful to recount.

"If it was appalling below deck it was more than appalling above. The 'Bluecher' was under the fire of so many ships. Even the little destroyers peppered her. 'It was one continuous explosion,' said a gunner. The ship heeled over as the broadsides struck her, then righted herself, rocking like a cradle. Gun crews were so destroyed that stokers had to be requisitioned to carry ammunition. Men lay flat for safety. The decks presented a tangled mass of scrap iron. In one casement, the only one, as they thought, undestroyed, two men continued to serve their gun. They fired it as the ship listed, adapting the elevation to the new situation. The 'Bluecher' had run her course. She was lagging lame, and with the steering gear gone was beginning slowly to circle. It was seen that she was doomed. The wounded 'Bluecher' finally settled down, turned wearily over, and disappeared in a swirl of water."

The Present Geographical Position of Serbia

By J. Cvijic

Serbia—the country which we of English speech so long miscalled "Servia," to the great annoyance of its inhabitants—has suddenly become an object of interest to the whole world, on account of the casus belli which it has furnished to the great Powers of Europe. Hence it seems timely to present the following abstract of a paper which appeared just before the outbreak of the present war in the recently founded Bulletin of the Serbian Geographical Society, as giving some idea of what the Serbs themselves think of the position of their country in contemporary geography.—EDITOR.

AFTER Montenegro, Serbia was the first Balkan state to emancipate itself from Turkish rule. In its original form, 1815-1833, it had an area of 7,790 square miles. Since that time it has spread mainly in a southerly direction. In 1833, enlarged by Prince Milosh, it attained an area of 14,570 square miles, and in 1878, after the Congress of Berlin, its surface amounted to 18,650 square miles. Since the treaty of Bucharest, 1913, the area is about 33,900 square miles. Along with these alterations in size, there has been a considerable modification of its original geographic position. It has gradually ceased to be a sort of outlying dependency of the great Pannonian basin and of the Austro-Hungarian monarchy, and has pushed its way south toward the center of the Balkan peninsula, along the axis indicated by the great valley of the Morava. At the same time, to a more and more marked extent, there have been added to the Dinaric Serbs, who constituted essentially the Serbia of Karageorge, the Serbs of the southern Morava and of the Vardar.

The territorial extension which followed the wars of 1876-78 definitely determined the development of Serbia toward the south. The country now not only included nearly the whole southern basin of the Morava and commanded the entrance to the Balkans, but also contained the focus of the two great highways intersecting the peninsula, viz., Nish, at the bifurcation of the road to Constantinople and that to Salonika. It had entered a new ethnic zone, in its spread toward Pirot and the southern Morava. This southerly movement had been forecast in the popular songs of the country, in which recurred the names of Kossovo, Prizren, Skoplie, Prilep, etc., and was stimulated by unhappy political and economic experiences in the north.

Serbia now occupies a truly central position in the Balkan peninsula, extending from the Danube to the vicinity of Salonika. To the Serbia of the Morava has been added the Serbia of the Vardar. The country possesses, through nearly its whole extent, the great central artery of the peninsula. Belgrade, Nish, Skoplie, and Salonika, which mark out this great natural route, are now about to assume the importance to which they are entitled. Moreover, Serbia now holds what may be termed the heart of the Balkans, viz., the region lying between Nish and Veles, and especially that including Skoplie and the Ovchepolye. In this region meet and intersect, or are destined to do so, all the great highways of the peninsula. Finally, the barrier between Serbia and Montenegro formerly presented by the sanjak of Novibazar has now disappeared; Bosnia is henceforth cut off from Salonika; while Serbia is now able to gain direct access to the sea by way of Montenegro.

When we consider the progress of the civilizing influences at work in Serbia we find that the Serbs, and especially the Dinaric Serbs, readily respond to such influences, but at the same time have the faculty of adapting new ideas to suit the national character. Serbia, unlike the countries constituting the other two Mediterranean peninsulas, is united to Europe by a great plain. Moreover, the shortest route from Europe to the rest of the Balkan peninsula, the Aegean, and Asia Minor passes through her territory. Again, the spread of the Serbian race beyond the frontier toward the north, and west to the Adriatic, tends to attach Serbia more intimately to Europe than any other Balkan state. Nevertheless Serbia is by no means so strongly dominated by the influence of her northern neighbors as these facts might lead one to suppose. More and more, in her intercourse with the rest of Europe, she tends to pass right over the vast Pannonian basin, the immense Hungarian *puszta*, in which dwell people who have remained strangers to her in language, mentality and institutions. By a curious geographic anomaly, not only is this great fertile plain devoid of any marked influence upon the rugged country which borders it to the south, but it actually plays the role of isolating the latter more effectively than a chain of mountains might do. Only two routes, Belgrade-Budapest and Belgrade-Fiume, put Serbia in communication with the countries beyond.

During a recent period, lower Austria and Bohemia were the regions which gave most to Serbia, especially in supplying the material needs of existence. In recent years this intercourse has very sensibly diminished. Ideas, policies, and institutions have come under the influence of western Europe. With the exception of medical students, who are still educated mainly at the Austrian universities, nearly the whole youth of Serbia obtains its higher education in more distant countries—France, Germany, Switzerland and Belgium.

Since 1913, Serbia, previously subject almost exclusively to European influences, has pushed southward into the regions of old Balkan culture—i. e., Byzantine civilization as modified by Turkey—a type of culture from which, however, Moravan Serbia had not yet had time to become completely divested since its liberation from the Turkish yoke. This finds expression, for example, in markets of wooden booths, crooked and narrow streets, cross-legged merchants selling a little of everything; household furniture, cuisine and costumes very different from those of Europe; marked contrasts between the civilization of the towns and the patriarchal life of the country, etc. Moreover, in the south Serbia has entered a zone of climates and products which are new to her.

The old Balkan culture seems destined to disappear from the Serbia of the Vardar basin as it has disappeared from Moravan Serbia, since its existence appears to be dependent upon the rule of the Turk. It will, nevertheless, leave enduring traces.

Along an extensive frontier Serbia now finds herself in contact with modern Greece. In this contact the Greek temperament will probably exercise a greater influence than the Greek culture. This is characterized by alertness, a strong commercial spirit, and intense national pride. She will also feel the influence of Salonika and the distinct type of culture of which that place is the center. Lastly, she will come more fully than in the past under various Mediterranean and Levantine influences.

On the east her contact with Bulgaria will continue to play a neutral role, as to effects on her culture; while her new frontier with Albania will exercise a somewhat unfavorable influence in this respect.

Berlin Higher Schools and the War

THE higher educational institutions of Berlin have been greatly affected by the war, says the Berlin *Lokal Anzeiger*. Of the 7,059 men and 976 women who are enrolled as students in the university 4,269 men and 75 women are on leave of absence for army and hospital service, and it is probable that many others have gone to the front without notifying the university authorities. Among the 238 foreign students of the university are 22 Russians and 1 Englishman. In the Charlottenburg Technical School, which had 2,634 students last summer, only 684 were enrolled for the winter semester, and so many of these have since been called to the colors that the actual attendance is probably less than 200.

The Academy of Music, which had 331 students last summer, now has only 203, of whom 20 are foreigners. The Academy of Fine Arts, which usually has 300 students in winter, now has only 100.

The Veterinary College, which last summer was attended by 140 pupils of the Military Veterinary Academy and by 333 other students, now has a total attendance of 108 students, most of whom are too young for military service. The attendance at the Agriculture College has fallen from 897 to 169.

The Royal Academy of Mines still has the names of 180 students on its lists, but 140 of these are "on leave," i. e., in the field. Finally, the High School of Commerce, which had 562 students, even in the summer, now has only 372 enrolled, and only 167 in actual attendance.

Protection from Frost

IT is safe to say that much more attention has been paid to the problem of protecting plants and trees from frost in the United States than in all other countries combined. The problem is far from complete solution, however, and hence there was ample room for the collection of memoirs on the subject which constitute almost the entire contents of the *Monthly Weather Review* for October, 1914 (published in February, 1915, by the Weather Bureau at Washington). This symposium begins with a summary review of the subject, from a physical point of view, by Dr. W. J. Humphreys, which is followed by contributions from Weather Bureau officials and others, dealing with the question practically, historically, and controversially.

Getting the Range

Instruments Which Make Gun Fire Effective at Distances Up to Ten Miles

CLOSE one eye, and then bring the tip of the index finger down upon any small object within reach and at about the level of the open eye. A man who has never tried this experiment will be astonished to find that his finger may overreach or fall short of the object by as much as an inch or more, and yet using both eyes, he could act with such accuracy as to bring two pinheads together at the very first attempt. This shows how much we depend upon triangulation for the judging of relative distances. With a camera one may gage distances up to one hundred feet or so by carefully noting the length of focus necessary to produce a sharp image on the ground glass. Similarly with the naked eye, we may estimate short distances by the change of focus in the eye itself; but for greater distances we have to utilize the principles of triangulation employed in range-finding.

In a loose sense of the term we are all "cross-eyed" most of the time. In order to see an object, the eyes must converge or turn in so that the optical axes will cross upon it. The nearer the object, the more they turn in. It is only when "day-dreaming," or looking at an object an infinite distance away, that the optical axes are strictly parallel.

Harking back to our school days, we recall that the triangle is a figure with which much mathematical juggling may be done. It possesses three sides and three angles, and if any one side and any two of the other five elements be known, the whole triangle, no matter what its shape, can be reconstructed, and the size of every angle and side be determined. Whenever we look at an object we solve unconsciously a problem in trigonometry. A triangle is formed, with the eyes at two corners and the object at the third. The base of the triangle is the distance between the eyes, and the convergence of the eyes gives us two angles at each end of the base. No one bothers to find out the length of this base line or the value in degrees of the two angles, but by long practice everyone has acquired an ability to gage the triangle by unconsciously testing the muscular strength required to train the eyes upon the object. While few of us have learned how to gage actual distances, we can all sense the relative size of triangles with such precision that, for objects within a short range, we can tell to a sixty-fourth of an inch whether one object is nearer to us than another; because in looking from one object to the other there is an infinitesimal contraction of the angle of convergence. The actual change in this angle is measurable in seconds of arc, and yet we can feel and gage the slight tug of the muscles necessary to swing the eyes through this minute angle.

The reason the change of angle is so small is because the distance between the eyes is but one fifth of a foot. But what if we had a broader eye-base? If our eyes were set apart as far as an elephant's, how much more distinctly would distant objects stand out in relief? What if we used some artificial means of virtually spreading them apart a dozen feet or more? That is what the modern range-finder does, and it is also equipped with means for measuring the convergence necessary to train the gaze upon a distant target. With a base of fixed length and the measure of the two angles at the ends of the base known, it is then a simple matter to reconstruct the triangle formed between the range-finder and the object and to determine the distance of the object from the range-finder.

Fig. 1 shows a typical range-finder which will be seen to consist of two telescopes with a single eye-piece. In the illustration the eye-piece is shown at *A*, and it will be seen that the telescopes run at right angles to the eye-piece in opposite directions, one of the objectives being indicated at *B* and the other at B^1, while the two crossed prisms *C* and C^1 turn the rays that enter the objective into the ocular *A*. At the ends of the range-finder tube are two pentagonal prisms, *D* and D^1, which divert the rays entering the apertures of the range-finder, and send them at right angles into the objectives. Thus, an observer at *A* will see two images, one above the other, the upper image being that which he sees through the right-hand end of the range-finder, and the lower image that which comes in at the left-hand end. The view will be something like that shown in Fig. 2, in which the upper half of the field of vision is out of register with the lower half. In order to bring the two images into coincidence, circular glass wedges *E* and E^1 are placed before the prisms *D* and D^1. By operating a thumb screw which is not shown in Fig. 1, because it lies above the plane of the section, the two circular wedges are simultaneously rotated, bending the rays that enter the range-finder until the two images seen in the ocular are brought into coincidence. A micrometer device measures the amount of rotation necessary to produce this result. But, instead of giving the measurement in degrees, it is calibrated to give the linear distance of the target from the range-finder. The calibration may be seen through the second eye-piece *F*, which, by means of a pair of prisms, is brought to bear upon the micrometer scale.

Of course, the longer the base line of the instrument the more efficient it is. Range-finders used on ships may use a base line a dozen or more feet in length, but for field service this would be entirely too bulky. The ordinary portable range-finder has a base between three and four feet long. In the case of fixed artillery in forts, ranges are found by placing observers a mile or more apart and connecting them by telephone or telegraph in such a way that they may make simultaneous observations from each end of this long base line and report to a common chart room where angles are worked out and the position of the target determined with a wonderful degree of accuracy.

Range-finding has been reduced to such a science that it is necessary to conceal batteries or guns. The battery must be kept out of sight, and it must fire at an enemy which also remains out of sight. The man who directs the firing may be at a great distance from his battery, located at some point of vantage, where he may obtain the range and signal it to his gunner. Knowing that at any moment he may become the target of the enemy's fire, and realizing the accuracy of modern artillery, it is very necessary for him also to remain concealed. Some of the methods of concealment are shown in the accompanying photographs. A system similar to that of the submarine periscope is employed in the German army, so that a man hidden behind a natural breastwork may raise his artificial eyes far above him. Even the top of the periscope is frequently disguised by wisps of straw, so that it is next to impossible for the enemy, at the enormous range of modern fighting, to discover his whereabouts.

Not only is it necessary to foretell the range, but the observer must confirm his estimate by watching the actual effect of the fire of his guns. He may find that he has underestimated the distance of the target and must signal to have the guns elevated accordingly. For such purposes a range-finder is not required, but field glasses may be used; these, also, are arranged like the periscope of a submarine to protect the observer.

The periscope raises the eyes far above the surrounding country.

A field telemeter or range-finder as used by officers of the Austrian army to study the positions of the Russian forces.

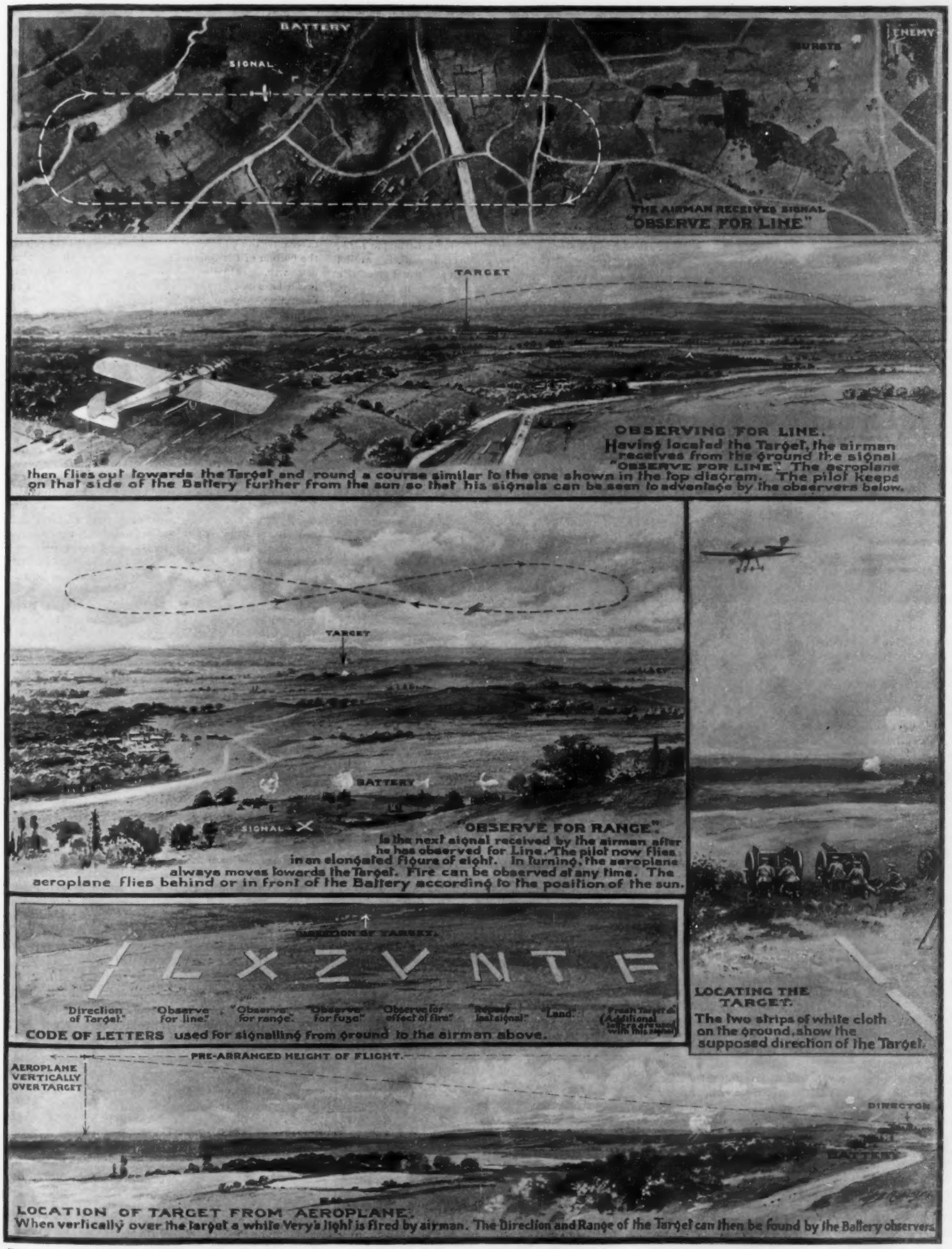
The observers, concealed behind breastworks, are endeavoring to locate and determine the range of the hidden batteries of the enemy in order to direct the fire of their own guns.

German officers watching the effect of their gun fire.

INSTRUMENTS FOR GETTING THE RANGE

In the present war the aeroplane has proved invaluable for locating the enemy and directing the fire of artillery. Herewith is a series of pictures illustrating how the man in the sky locates and signals the range to the man behind the gun. The aviator rises to a prearranged height and, maintaining that altitude, flies in the supposed direction of the enemy. As a guide, strips of white cloth are laid on the ground. Such a guide is shown in one of the illustrations, but it will be understood that this, as well as the code letters, are merely typical signals, and do not represent any actually in use. After the airman has located the target, he sails right over it and signals by dropping a Very's light, using one or a number grouped in some prearranged combination. Two observers near the guns with instruments between them check the distances automatically, which they can do with considerable accuracy since the aeroplane's height above the ground is known. The firing can then begin. The direction or line of firing is checked by the airman, who steers in an elongated oval between the batteries and the enemy, signaling with Very's lights. Similarly he reports how the shells are bursting, whether short or beyond the target, or whether they are landing true.

The range-finder we have shown in Fig. 1 is merely typical of the kind usually employed. There are a great many modifications of it; too many to describe here. In some the upper half of image field is inverted, as shown in Fig. 3. This is claimed to give a better guide to perfect alignment of the two images. In other range-


BATTERY
SIGNAL
BURSTS
ENEMY
THE AIRMAN RECEIVES SIGNAL "OBSERVE FOR LINE"
TARGET
OBSERVING FOR LINE.
Having located the Target, the airman receives from the ground the signal "OBSERVE FOR LINE". The aeroplane then flies out towards the Target and round a course similar to the one shown in the top diagram. The pilot keeps on that side of the Battery further from the sun so that his signals can be seen to advantage by the observers below.
TARGET
BATTERY
SIGNAL
"OBSERVE FOR RANGE".
is the next signal received by the airman after he has observed for Line. The pilot now flies in an elongated figure of eight. In turning, the aeroplane always moves towards the Target. Fire can be observed at any time. The aeroplane flies behind or in front of the Battery according to the position of the sun.
DIRECTION OF TARGET.
"Direction of Target."
"Observe for line."
"Observe for range."
"Observe for fuze."
"Observe for effect of fire."
"Repeat last signal."
"Land."
CODE OF LETTERS used for signalling from ground to the airman above.
LOCATING THE TARGET.
The two strips of white cloth on the ground, show the supposed direction of the Target.
PRE-ARRANGED HEIGHT OF FLIGHT.
AEROPLANE VERTICALLY OVER TARGET
DIRECTON
BATTERY
LOCATION OF TARGET FROM AEROPLANE.
When vertically over the target a white Very's light is fired by airman. The Direction and Range of the Target can then be found by the Battery observers.

By courtesy of the *Illustrated London News.*

Why the flying man is indispensable to the man behind the gun: how the target is found and the range is checked.

Periscope field glasses concealed by a wisp of straw.

Japanese using a range-finder at Tsingtau.

finders prisms are avoided and mirrors are used instead, so as to overcome distortions due to variations of color. Yellow rays predominate if the air is saturated with moisture, red if the air is dry, and blue or blue-green on a dull, cloudy day, and so the range-finder will be found to err in overestimating or underrating the distances, according to the state of the weather. These, however, are refinements which only concern the man who has actually to use these instruments.

There are some range-finders based on entirely different principles from the one we have illustrated in Fig. 1. Figs. 4 and 5, for instance, show a range-finder which depends upon a knowledge of dimensions of the target. If, for instance, we know the height of the stack of a battleship above water, we may readily determine the distance of this target from us by measuring the height of the image produced in our field glass. Fig. 5 illustrates the principles of the device. Here we have two triangles meeting at the object glass G of the telescope, the line H, I being the known height of the target and H', I' the height of its image in the telescope. The two triangles are similar, hence one is as much larger than the other as H, I is larger than H', I'. The method of measuring H', I' is shown in Fig. 4.

Attached to the eye-piece of the telescope is a device containing a pair of disk prisms or wedge-shaped plates of glass, which may be adjusted by means of a micrometer screw to elevate a part of the image. When, as in Fig. 4, the elevation is sufficient to bring the water-line of the part seen through the prisms to a level with the smokestack shown in the rest of the image field, the height of the image of the smokestack above the water is measured on the micrometer scale. But, instead of giving this height in fractions of an inch, the device may be set for a unit height, when the scale will give the actual distance of the object. In this case, for instance, the height of the smokestack may be 25 yards above the water, and the observer may know that for such a height each mark represents a hundred yards. As the observer found it necessary to turn the scale until 25 came opposite the marker, he knows at once that the battleship is 2,500 yards away.

It is seldom that one can depend upon an instrument of this sort, because the enemy may so readily change the dimensions of his ship and thus deceive the observer. However, this device may be used in conjunction with an ordinary range-finder, so that once the distance of the ship has been discovered, this simple instrument will show whether it is moving farther away or toward the observer and at what rate. For this reason it has been termed a "range-keeper."

Another range-finding device depends upon the known height of the observer above water level. This instrument, of course, can be used only on the sea, or in taking observations from the land on objects at sea. As is commonly known, the horizon lies always practically at the level of the eye, so that a line running from the eye to the horizon is practically a horizontal line. A truly horizontal line may be obtained by taking observations on the horizon fore and aft, at the same time, with a double telescope, and correcting the instrument accordingly. Now, if an observer is situated twenty-five yards above the sea and wishes to discover the range of an object between him and the horizontal plane, he may measure the angle through which he must depress the axis of one of his telescopes to train it upon the object, while the other remains fixed upon the apparent horizon. As is shown in the insert in Fig. 6, the apparent horizon or truly horizontal line is indicated by the line KL and l is the angle it makes with the object located at M. The observer knows his height above water level, which is LN, and drawing a line from M to N, we have a right-angled triangle LMN, in which the line MN, being also horizontal, is parallel to the line KL. Now, the angle l must equal the angle m, as our geometries taught us long ago, and we have, thus, a triangle in which one side LM and two angles m and n are known. With this knowledge we can easily estimate the length of the side LM or MN and determine the distance of the target M from the top or the bottom of the tower. The advantage of this system, of course, lies in the fact that it gives the observer a broad base line to work with, and thus enables him to determine the position of the target with greater accuracy.

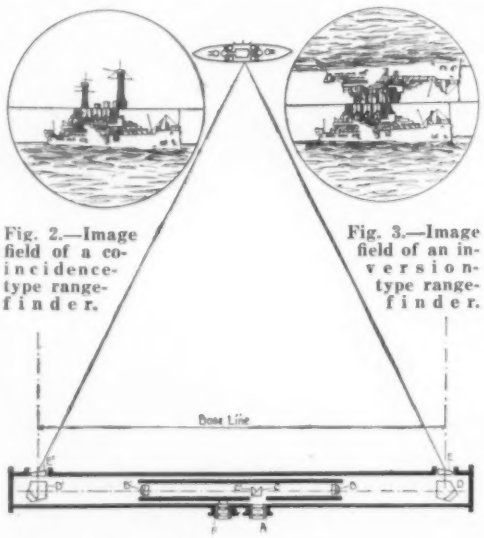


Fig. 2.—Image field of a coincidence-type range-finder.

Fig. 3.—Image field of an inversion-type range-finder.

Fig. 1.—Diagrammatic view of a typical range-finder.

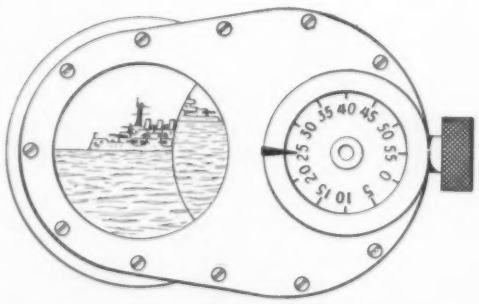


Fig. 4.—Instrument for measuring the image of an object of known height.

Fig. 5.—Range finding based on similar triangles.

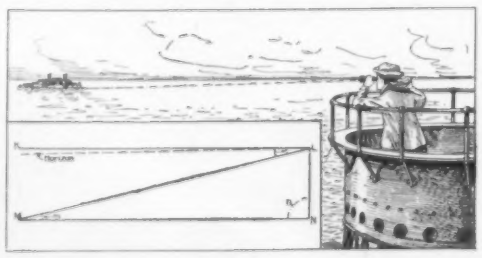


Fig. 6.—Range finding in which the observer's height above the sea serves as a base line.

The Death of H. Ward Leonard

H. WARD LEONARD, electric engineer and inventor, once associated with Thomas A. Edison, died suddenly of apoplexy recently at the Hotel Astor.

Mr. Leonard was born in Cincinnati in 1861, and graduated from the Massachusetts Institute of Technology. The following year, at the age of 23, he became associated with Thomas A. Edison as a member of his staff of engineers to introduce his central station system. A few years later he was made superintendent of the Western Electric Light Company of Chicago, and a year later formed the firm of Leonard & Izard, which made many important installations of central stations and electric railways. In 1889 the firm was bought out by the Edison interests and Mr. Leonard became general manager of the combined Edison interests for the United States and Canada, with headquarters in this city.

In 1891 he completed his inventions of the Ward Leonard system of motor control, and in 1892 he gave the world his multiple voltage system, designed for operating motors and electric lights in factories. The value of the Ward Leonard system of control was demonstrated in battle during the Spanish-American war, where it was used on one turret of the "Brooklyn." After the war it was generally adopted by the United States Navy, and all of the ships were equipped with it with a few unimportant exceptions.

Another of Mr. Leonard's important inventions was the double-arm circuit breaker, which has come into almost universal use. Other important inventions are his lighting system for trains and automobiles and his form of change gear, which is now used in most high-grade motorcars. His system of motor control was applied to the moving side-walk at the Paris Exposition of 1900 after many ineffectual attempts to operate it by other systems, and was a feature of the exposition.

Mr. Leonard was a prolific inventor, having taken out over a hundred patents, including many connected with electric power, light and transportation systems. He was the founder of the H. Ward Leonard Manufacturing Company of Bronxville, N. Y.

Farming in Siberia

WE have inherited from the traditions of the past the idea that Siberia is a country with a not very fruitful soil. Yet in the last few years very decided advances in farming have been made there, as a result of the efforts of the Russian government to arouse the native peasants and settlers to a more intensive cultivation of the ground. In the western section of the country, so the German journal *Prometheus* tells us, large associations of farmers have been organized for the export of their products. In 1912 butter to the value of 7,000,000 rubles (a ruble is about 51 cents) was exported. In 1913 this amount had doubled, for in this year butter to the value of 14,500,000 rubles was sold to Germany, Austria-Hungary, and England. In 1912 experiments were made in the manufacture of the English Cheddar cheese. After several failures the cheese, which is very popular in Great Britain, was so successfully imitated that in 1913 England imported 65 tons of Siberian Cheddar. The trade is carried on by ships directly from the interior of Siberia to London.

Doing Without Europe—VI

How Research Developed the Paint Industry: the Attitude of Our Bankers Toward Research

This is the concluding installment of a series of articles on the possibilities of industrial research, not only by relieving the strain under which some manufacturers find themselves because they have been cut off from their European base of supplies, but also in building up new manufacturing enterprises. The Editor will be glad to answer any questions that may suggest themselves to our readers and to assist them in securing the right kind of expert advice in bettering their manufacturing processes.—EDITOR.

PERHAPS no better example of the part that organized research can play in our industries could be cited than the truly marvelous development of the American paint industry. The whole mixed paint industry of our day is to a large extent dependent on exact chemical and physical knowledge of the composition and effect of pigments. The making of paint and varnish products in a haphazard manner by untrained men, through closely guarded secret processes, has been stripped of its secrecy and its false importance. The raw materials entering into paints immediately became the subject of exhaustive study. Their chemical composition, physical properties, and actual value were determined with accuracy and kept subject to careful chemical control. Traditional beliefs were shown to be based upon ignorance. Newer commodities were gradually developed and their value proved. The principles of science were applied to the various processes of manufacture. Newer and better designed machinery and equipment were provided. Savings were effected at various places and wastes were largely eliminated. As a result of these changes the industry forged rapidly ahead.

In discussing the development of the paint industry along scientific lines Mr. Maximilian Toch has pointed out that ten years ago the interior walls of buildings were generally left bare and in an unsightly condition. The production by the manufacturer, through the use of newer pigments and oils, of a wall paint which would dry to a soft, velvety flat finish, and which could be easily and economically applied, created a wider desire for wall decoration. People started to paint the walls of their homes, their offices, and their factories. With this newly-created demand for the newer paints came a proportionate demand for the services of the painter to apply them. In creating a market for their paints, the grinders also created a market for the services of the painter. For every million dollars' worth of paint sold, there came requirements for at least two million dollars' worth of painting labor. The cost of applying paint is always at least twice the cost of the paint applied.

There are now many paint and varnish specialties. The special white enamels which were recently introduced were looked upon a few years ago as of questionable necessity. Nevertheless it would be hard to estimate the enormous amount of painting business which has resulted primarily from the efforts of the grinder in introducing and popularizing such enamels. The nation-wide advertising of such products by the producers created a desire among home owners to have the interior trim of their dwellings done in white glossy enamel. The beautiful appearance of such work stimulated others to call upon the painter for similar work. To-day the amount of such products which are sold and used will probably run up into the millions. If the grinder had not produced and created a demand for such enamels, the thought of enamels or enameling would probably never have occurred to the property owner and the painter would have had much less work to do.

What Research Has Done for the Paint Industry.

As soon as the chemist entered the paint industry, such vehicles as soya bean and China wood oils received marked attention. China wood oil is to-day such a necessity that the revolution in China brought the price of the oil up to $1.10 and proved thereby that the oil was indispensable to the paint and varnish maker at any price. When the price of turpentine reached $1.13 a gallon in March, 1911, the United States Navy decided that industrial research would enable it to obtain a good turpentine substitute from petroleum. The Government is now buying thousands of gallons of turpentine substitute for which it pays from 12 to 15 cents per gallon. As the Navy purchased in 1910 about $70,000 worth of turpentine, this innovation has had a tremendous effect on the turpentine market, and the chances are that it will never see such an abnormally high price again.

The battleship gray which the Government has partially adopted for the navy is made of 45 per cent zinc oxide and 45 per cent barium sulphate, with the necessary tinting material to produce the shade. A paint made of such materials costs about 25 per cent less than the lead and zinc paints which were formerly used. The results showed that the zinc oxide and barium sulphate paint dried with a harder film and was not affected by salt water as much as the lead paint formerly used.

A similar condition of affairs has developed in the maintenance departments of the large railroads of the United States, and they have come to realize that no single pigment is as good as a mixture of pigments, and no single pigment is as good as a pigment which contains a reinforcing material in limited amounts.

There could well be a further great enlargement of the field of industrial research in special industries through the initiative and support of national trade associations, to the great benefit of their membership, as Mr. Arthur D. Little pointed out. The American Paper and Pulp Association, he maintains justly, should subsidize studies in the utilization of waste sulphite liquors, the paper-making qualities of unused woods and fibers, the hydration of cellulose, the proper use of alum, and so on. The American Institute of Metals could not do better than initiate investigations into zinc losses, the physical properties of alloys, and the production of alloys to specifications defining the properties desired, the application of the electric furnace to the industry, and the preparation of new alloys by electric or other methods. A similar opportunity knocks at the door of the American Foundrymen's Association. Some few associations, like those of the Bakers and the Laundrymen, are already active to good purpose; others like the Yellow Pine Lumber Manufacturers' Association, are aroused; but, to the great majority of those powerful organizations, research is still an academic question to be considered by their members individually if they so choose. Every industry has, however, its broad research problems, and its points especially vulnerable to research attack, among which it should be easy to select those of general interest to the industry as a whole.

The National Canners' Association, a large and representative organization of food packers, came to the conclusion that for the good of their own industry it was necessary for individual subscribers to provide a fund of money for investment in research work. In order to study the possibilities of this field, this association began its work in a conservative way with the help of the Institute of Industrial Research of Washington. After several years' experience had been gained with respect to the value of such systematic research work, the National Canners' Association decided to organize and build for themselves in the city of Washington a national research laboratory to study the problems of their industry and to enable their members to increase and develop the quality of their products, and thus enable them to conform with the law, rules, and regulations issued under the Food and Drugs Act of 1906. It is almost needless to state here that the example set by the National Canners' Association might well be followed by many other trade organizations in this country, none of which probably need to benefit by this example more than the National Association of Retail Druggists and the American Pharmaceutical Association.

Other special industries have evinced the greatest possible interest in the value of industrial research. Thus, in 1900 the American Railway Engineering Association took the matter in hand and studied the influence and extent of segregation of specific impurities in steel rails. The great railway systems have been quick to co-operate in these researches, which, with others of fundamental importance, have been extended by the American Society for Testing Materials, the Master Car Builders' Association, and other organizations. Materials of construction have constituted a fertile subject of inquiry in the structural materials testing laboratory of the United States Geological Survey as well as in the Bureau of Standards.

The Attitude of the Banker Toward Industrial Research.

But there is another side to this question of industrial research. Our bankers have been rather apathetic to the commercial possibilities of scientific investigation. They must see things very concretely before they will aid in their exploitation financially. A machine, however crude and imperfect, has a tangible existence; a scheme for extracting theobromine from cocoanut shells resembles a lunatic's dream. That is why we have developed machinery rather than processes.

In 1894 Acheson, the discoverer of carborundum and artificial graphite, laid before his directors a scheme for moving to Niagara Falls. To quote his own words: "To build a plant for 1,000 horse-power in view of the fact that we were selling only one half of the output, of a 134 horse-power plant, was a trifle too much for my conservative directors, and they one and all resigned. Fortunately, I was in control of the destiny of the Carborundum Company. I organized a new board, proceeded with my plans, and in the year 1904, the thirteenth from the date of the discovery, had a plant equipped with 5,000 electrical horse-power and produced over seven million pounds of those specks I had picked off the end of the electric light carbon in the spring of 1891."

Contrast this experiment of Acheson's with financial men with Chardonnet's relations to his backers. Chardonnet made a dead failure of his artificial silk process when he tried it out commercially, not once but four times, but financial assistance was given him, instead of condemning him as a fraud or faker, and the process as a swindle. German chemical firms spent millions before a dollar's worth of goods was marketed. "The chances are that an industrial chemist in this country who could not revolutionize conditions or produce ideal results in a few months time, would be fired for not knowing his business," in the words of Prof. Robert Kennedy Duncan.

A prominent industrial chemist put the matter to the writer of these articles in the following terms:

"We have no medicinal plant industry in this country, although the risk involved in starting the industry is small and the profits to be made enormous. Take menthol, as an example. It is one of the most widely used of plant derivatives. The source is a Japanese mint, so carefully guarded by the Japanese government that seeds can be obtained only with the greatest difficulty. I have succeeded in securing some of this seed, and Japanese mint is now flourishing on my experimental farm. Digitalis, belladonna, and similar drug-plants are also growing. I sunk in this experiment many thousand dollars, confident that the investment will pay rich dividends. I need about $45,000 to establish a profitable medicinal plant industry in America—surely no extravagant sum. Can I interest a banker in my project? No. Why? Because he cannot grasp the possibilities of chemistry. If I wanted to establish a poultry farm I would have no difficulty whatever in raising $45,000. That is because bankers know something about hens and eggs."

Why the War Cannot be Preserved in Motion Pictures

By Ernest A. Dench

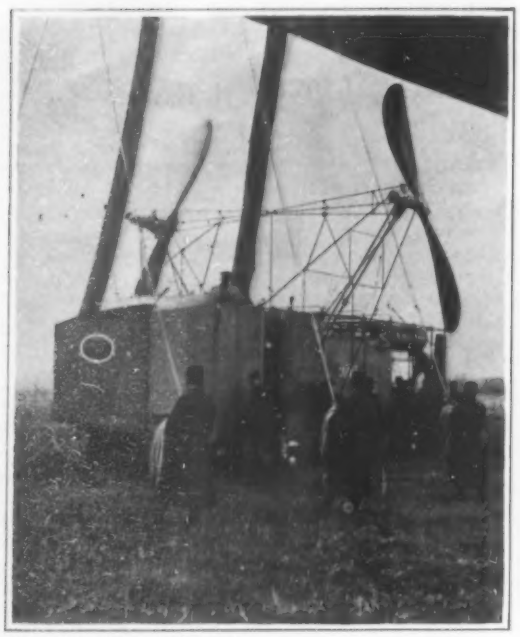
BRITAIN has been adversely criticized, even by its own countrymen, for not availing itself of motion picture photography to bring the great war before future generations. But despite all these well-meant appeals, the British authorities have been obdurate to taking action in the matter. Their attitude, in less informed quarters, has been attributed to their characteristic conservatism, but such is not the case this time.

For many years, British scientists have been studying the problem of whether the film will retain its good properties after years of age. They have made the discovery that after an unused film has been placed in an airtight vault for five years fungoid growths cover the celluloid, thus proving that, when put to the actual test, the proposition of preserving motion pictures a hundred years or more can be dismissed right away. As yet the chemicals used to develop and print the film, and the celluloid on which it is made cannot stand the test of time. It will only be when a more permanent substance is discovered by scientists that this will become a feasibility.

The authorities of the British Museum, which is the official repository for historical records, also have a reason for their reticence. They decline to store film because of its highly inflammable nature. The only way to get over this would be to erect a special vault, which the authorities decline to do. You can, therefore, realize that, for once in a while, the versatility of the motion picture has been over-estimated.

On the other hand the German government is said to be taking motion pictures of the war, despite fungoid growths and the danger from fire.

Winds Favorable to Forest Fires.—The Weather Bureau has recently made some study of the meteorological conditions favoring the occurrence of forest fires, and has tentatively established a special service for issuing warnings of the hot, dry winds which seem to be a frequent antecedent and accompaniment of such fires in the valuable timbered regions of the West.



Photograph from Underwood & Underwood.

The armored car of a French military dirigible of the Astra-Torres type.

Copyright by Underwood & Underwood.

Belgian dams hold back the floods from Nieuport to Barrescappeles and prevent the water from encroaching on the Allies.

Photograph from Underwood & Underw

A mortar captured fr the G Nieup .

Photograph by Branger.

A company of French Alpine chasseurs on the march in the Vosges Mountains. Alpine stocks are part of their military equipment.

Copyright by Underwood & Underwood.

One of the French guns in the act of firing. gun c A special track must be l the tr

Photograph by Branger.

A French cavalry regiment and its supply wagons encamped in a public square.

Photograph by Branger.

French soldiers encamped in a public park waiting the order to march.

NEW PICTURES FROM THE EA N ANI

ed fr the Germans near Nieup.

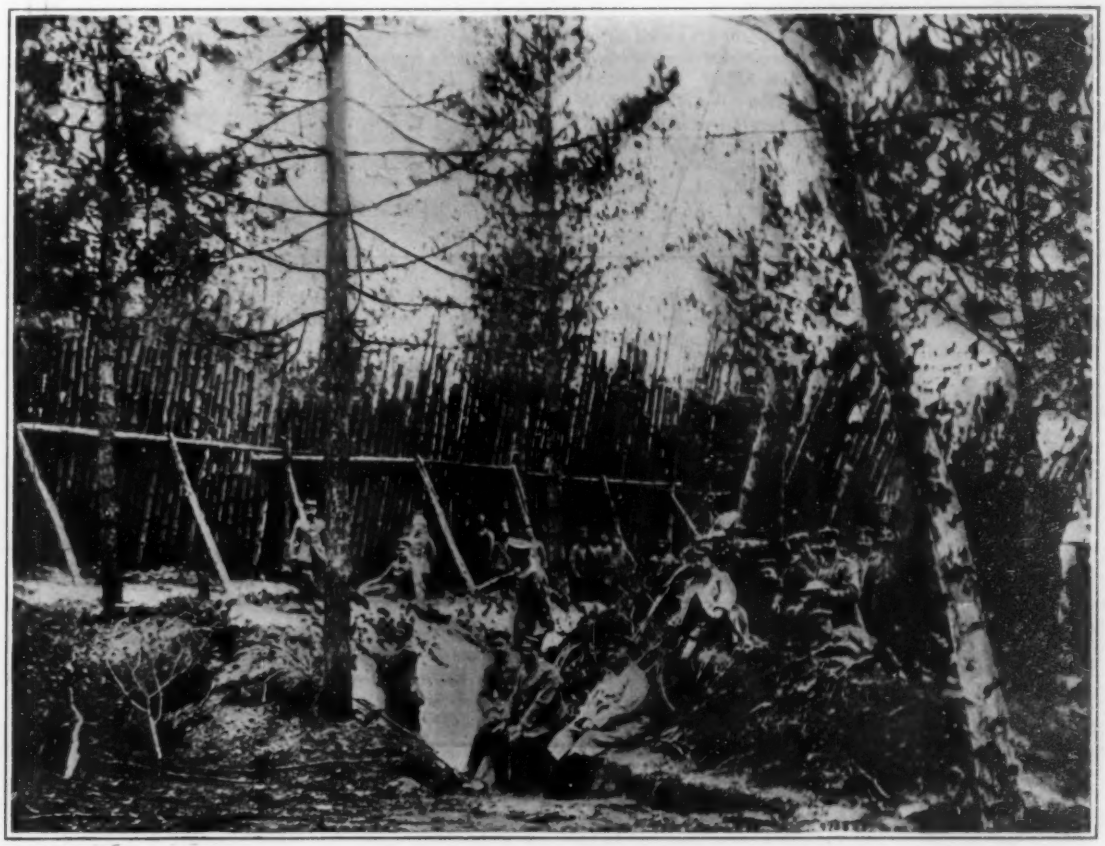
Photograph from Underwood & Underwood.

Training English recruits to carry pontons. These men will soon be erecting bridges across streams under fire.

Photograph by Paul Thompson.

A German machine gun company on the eastern battleground.

ng. gun crew are holding their hands to the ears.
e li the transportation of the gun.



Photograph by Underwood & Underwood.

The German trenches at Soissons are surrounded with palisades. The German soldiers are seen resting during an interval in the fighting.

Photograph from Paul Thompson.

The brickworks at Darkehmen destroyed by a Russian 15-centimeter shell.

Photo. by Sport & General War Service.

French soldiers guarding the road examine all vehicles to inspect passes.

EA N AND WESTERN THEATERS OF WAR

Ago has seats far apart. Passenger immediately behind engine. Pilot placed half way along fuselage.

ALBATROS *has rectangular section fuselage with no internal cross bracing. Rigidity given by three-ply wood covering screwed on fuselage longerons. Aluminium engine casing with large inspection doors. Radiator placed above engine.*

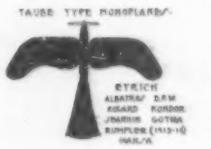
AVIATIK (1913-14). *Turtle back extends to rear of pilot's cock-pit, which is placed farther forward than usual owing to slight back-sweep of planes.*

AVIATIK (1914-15). *Contrary to usual custom employs rotary engine—114 horse-power Oberursel. Steel tube struts of stream line section connect main planes, which have very slight rearward slope. Monoplane type cabane serves as anchorage for center portion of top plane. Lighter construction throughout than usual on German machines.*

ROLAND (L. F. G.). *Vertical dihedral angle of lower plane very pronounced. Rudder, hinged to rear edge of tail pin, is mounted wholly above elevator. Fuel tank is placed between passenger and pilot.*

D. F. W. (1913-14). *Fuselage, tapering to horizontal knife-edge at rear, is built entirely of steel. Struts and cross members, made of steel tubes, are secured to longerons by steel clips and acetylene welding. Cross bracing wires are attached to these clips.*

D. F. W. (1914-15). *Upper plane is considerably in advance of lower. Both have wing tips of distinctive form. Steel construction is used throughout. Chassis copied from Morane. Empennage resembles that of new Rumpler Taube. With 120 horse-power Austro-Daimler engine it develops speed of 85 miles per hour.*



ETRICH. *These machines differ in only minor points. (See general description.)*

ALBATROS. *Chassis interchangeable with that of biplane.*

D. F. W. *Has cable as well as girder bracing. Chassis consists of two wheels and central skid bent upward in front to meet fuselage. Used mainly for school work.*

KONDOR. *Fuselage of circular section.*

JEANNIN. *Latest model has cable instead of girder bracing. Radiator carried above engine. Chassis similar to D. F. W.*

GOTHA. *High turtle back along top of fuselage. A plowshare-like brake operated from pilot's seat is attached to chassis.*

RUMPLER (1913-14). *Very deep and narrow fuselage. Rectangles are cut out of inner front portion of wings for observation.*

A. E. G. *Back swept wing tips to overhanging upper plane. Fuselage rectangular in front, triangular at rear. Flexing elevator employed. Balanced rudder is placed above tail plane. Chassis consists of two wheels to take weight and small third wheel in front to protect tractor in bad landing.*

RUMPLER (1914-15). *Wing bracing is by stranded cables instead of girder. Ailerons are used in place of flexing wing tips. Flexing elevator and double rudder are replaced by hinged elevating flaps and single rudder attached to stern post.*

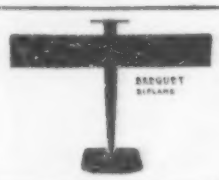
RUMPLER (1914-15). *Chassis is of Arrow type.*

JATHO. *Steel used throughout even to wing ribs. Standard tanks carry sufficient fuel for 7 hours. At speed is 78 miles per hour radius of action is about 273 miles.*

L. V. G. *Although leading edge of planes slope back in plan trailing edge is straight. Both planes are set at dihedral angle. Chassis is composed of two main wheels and central skid having small auxiliary wheel at its front end. Skid may be removed to reduce head resistance.*

HARLAN. *Zanonia type wings are swept back in arrow form and set at a pronounced dihedral angle. Fuselage very deep and narrow. Planes uncovered for a distance of one foot on each side of fuselage to provide downward view. Chassis has two wheels and central skid.*

BLÉRIOT. *Little changed in last five years. Rectangular fuselage, partially covered in, tapers to vertical knife edge at rear. Elevator mounted below fuselage. Semi-balanced rudder hinged to stern post. Passenger in two-seater placed well behind trailing edge of wings. "Total Vision" model has plane mounted on level with occupant's eyes, reducing dead angle of vision to almost zero. Chassis of "deformable triangle" type having high head resistance.*



BRÉGUET. *Fuselage is composed of four steel tubes connected with struts, cross-members and diagonal bracing. On this structure are mounted wooden distance pieces joined by longitudinal stringers which give fuselage its streamline form, the whole being covered with fabric. Only one row of interplane struts is employed. The tail is cruciform in shape, and is attached to fuselage by universal joint. An ingenious three-wheeled chassis is used.*

CAUDRON. *Main spars of planes are close together and the trailing edge is flexible making for stability in gusts. Upper plane has considerably greater span than lower. Short nacelle contains seats for passenger and pilot arranged in tandem. Chassis consists of two pairs of wheels and two skids extending backward to form lower tail booms toward which upper booms converge. Twin rudders are mounted on top of stabilizing plane with which flexing elevator is incorporated. A single seated biplane with fuselage and hinged divided elevator is also made; two planes are of equal span.*

The Flying Machines of the Warring Powers

A Comparison of the Military Aeroplanes of France, England and Germany

By John Jay Ide

THE various types of aeroplanes used in warfare may be classified as follows:

1. The single seated scout of exceptional climbing powers for long range reconnaissance in any wind and of such speed as to be able to escape from any type of fighting machine produced up to the present. In this class France has the Deperdussin, Ponnier, Morane, Clement-Bayard and Nieuport. The Blériot and R.E.P. although distinctly inferior in speed also come under this head. England possesses the Avro, Sopwith and Bristol Scout or "Tabloid" biplanes. Single seaters are almost unknown in Germany and probably none are used in the army. In this connection, however, it should be noted that many two seaters are used as single seaters, the excess lifting power being utilized in carrying a larger quantity of bombs and fuel.

2. The fast two seated reconnaissance machine capable of carrying in addition to the observer a moderate number of bombs. In France all the makers of one seated monoplanes produce this type, and, in addition, there are two small biplanes: Caudron and Goupy. England has, besides those mentioned above, Blackburn and Martinsyde (monoplanes, not much used), and R.A. F., Vickers and Grahame-White. In Germany a few Tauben and the latest Aviatik and D.F.W. Arrow biplanes come under this head.

3. A machine having only moderate speed but a great radius of action. The large supporting area renders it capable of carrying a heavy load of bombs and darts. In France the Henry and Maurice Farman, Bréguet, Voisin and the Paul Schmitt represent this class. In England Grahame-White and Short build great weight carriers. The bulk of German machines are included in this division.

A few machines of types 2 and 3 carry machine guns. Where a tractor screw is employed, however, the firing arc is very limited except when the gun fires over the tractor as described in the SCIENTIFIC AMERICAN for April 11th, 1914.

England's Aeroplane Policy.

The early English biplanes were simply copies of the H. Farman of the period. In 1911 Mr. A. V. Roe brought out a fuselage tractor biplane which was widely imitated. The powers that be have always discouraged monoplanes and, for some time, prohibited their use in the army. The British government in the past did little to encourage the home industry, buying many H. Farmans and establishing a factory of its own where the Royal Aircraft Factory biplanes are made. One R.A.F. model known as "Mark B.E." was very deficient in spiral stability, having no fin area to neutralize the fuselage walls forward. The latest type, "Mark R.E." is well designed and inherently stable to some extent.

The typical British biplane has a rectangular section fuselage stream lined on top and inclosing a Gnôme motor at the bow. The pilot and passengers are seated in tandem, the former in the rear.

Staggered planes have become quite popular especially on single seaters. With this construction the gap can be made smaller without loss in efficiency and better observation is obtained. The new Scouts have only one pair of interplane struts on each side of the fuselage.

Twin elevating flaps are hinged to the rear of the flat stabilizing plane. The balanced rudder is attached to the stern post of the fuselage.

Where France Stands.

Until 1913 French government orders were distributed freely among all the better firms, but in that year this system was changed and orders were confined to a few favored factories. This had the effect of driving a number of firms out of business, a state of affairs no doubt bitterly regretted at present when the government cannot get machines quickly enough to make good the great wastage. During 1913 there was also very little encouragement given to French pilots, the only two competitions of importance being the Monte Carlo Hydro-aeroplane meet and the Gordon Bennett Cup, neither incidentally being of much value in developing the army machine. In consequence many pilots were forced to give up aviation as a profession. For some months before the war strong rumors were afloat to the effect that the government intended to start an aeroplane plant of its own as had been done in England to the detriment of the private manufacturer.

French machines have had their features described so often in the columns of the SCIENTIFIC AMERICAN that it is unnecessary to repeat them here. Some of the outstanding features of the two most successful war machines France possesses—the Morane and Caudron—are mentioned alongside their silhouettes. It has been found that these machines excel in climbing ability which is far more important than mere horizontal speed. By it one is enabled to escape or attack the enemy at will; if the latter alternative is chosen the most advantageous position can be secured.

Rotary motors are used almost exclusively. They require so much care that they have not given satisfaction in the war. The principal advantage of the rotary motor—lightness—is largely neutralized on long journeys by the greater weight of fuel necessary as compared with the stationary type.

How Germany Has Developed.

German aircraft firms and pilots have received strong financial support since the inception of the industry. In the last two years a number of competitions have been held with very large prizes distributed in certain proportions to the winning pilots and makers of the successful aeroplanes and engines. Liberal prizes were also given for important isolated performances. Owing to this encouragement Germany possessed at the beginning of the war a very large and well trained aviation corps and a score of flourishing manufacturers producing machines to government approved specifications. The aeroplane fleet is remarkably homogeneous, many different marques having almost the same carrying capacity, speed and radius of action.

Most of the early German machines were absolute copies—sometimes authorized, more often not—of existing French types. In 1910 the Etrich Taube (dove) came into prominence, being manufactured by Rumpler to the designs of Igo Etrich, an Austrian engineer. The wing shape was derived from the Zanonia leaf, and Herr Etrich had been building monoplanes on this principle since 1907. As this machine is typical of a large class of monoplanes a short description may be given.

The wings have back-swept upturned tips flexed up and down for the maintenance of lateral stability. Instead of the usual system of lower bracing cables, a biplane type of bracing is secured by means of a boom running some distance out from the fuselage below and parallel with the plane to which it is connected by short struts diagonally cross-wired. The outermost strut is continued upward above the plane, forming a king post to which the cables keeping the wing tips in their upturned positions are attached.

The fuselage of regular trapezoidal section with the wider base above is provided with a turtle back along its entire length. The flexing elevator forming a continuation of the tail plane divides the rudder into two sections each preceded by a small fin. Pilot and passenger sit in tandem, the latter being placed forward for observation purposes. The landing chassis of the Blériot type increases the great head resistance caused by the complicated bracing system. The Tauben, however, have a high degree of inherent stability.

The great majority of German biplanes belong to the Arrow type, so-called from the backward sweep of the planes. The lower plane is also given a slight dihedral angle as viewed from the front. Lateral stability is maintained by ailerons fitted to the upper plane only. Pilot and passenger are placed in separate cockpits as in the Taube. The top of the fuselage, which tapers to a vertical knife-edge at the stern, is covered with a turtle-back. Twin elevators are hinged to the stabilizing plane and the unbalanced rudder is preceded by a small fin. The tail planes are protected against contact with the ground by a short swivelling skid. The chassis is generally of the simplest type consisting of two pairs of streamline steel tube struts, each pair of which forms a V as seen from the side. A tubular axle sprung by rubber shock absorbers and carrying two disk wheels rests in the angle formed by the converging struts.

The rotary engine is almost unknown in Germany. The favorite motor is the 100 horse-power 6 cylinder vertical Mercedes, although 4 cylinder Argus motors of 100 and 150 horse-power are also much used. The motor is mounted on the bow of the fuselage driving a tractor screw. On the latest Rumpler Taube the Mercedes motor is inverted thus slightly lowering the center of gravity and improving the vision. The greatest difficulty, that of lubrication, has been surmounted. Twin radiators are generally employed, one being mounted on each side of the fuselage.

The Germans are certainly wise in employing the stationary motor, if only on account of its ability to withstand neglect. It is doubtful, however, if the vertical type will survive when higher powers are desired. The V type offers much greater freedom from vibration.

One of the greatest difficulties to be faced by the armies is the keeping up of aeroplanes in the field. In this respect France has the easiest task as St. Cyr and other permanent bases are comparatively near the central portion of the battle line. Incidentally these bases are also within range of German machines.

For weeks at a time machines have to be kept in hastily established aviation parks some distance behind the trenches. Of course all the nations have demountable hangars in use but it is equally certain that they are not in sufficient numbers to house a large proportion of the machines. It is not to be expected, therefore, that, between the enemy and the elements, aeroplanes last any great length of time. The wastage in fact is simply enormous and the factories of the countries at

(Concluded on page 234.)

DEPERDUSSIN. *Monocoque fuselage of circular section cutting down head resistance to a minimum. Good entry is secured by very large stream lined tractor boss. Chassis consists of U-shaped stream lined struts from which is slung, by rubber shock absorbers, a tubular axle carrying a pair of disk wheels. Stabilizing plane is slightly cambered. Rudder is attached to small triangular fin.*

NIEUPORT. *Wings are of so-called Phillips' sections having reverse curve at rear. Rectangular fuselage is very deep in region of seats. These features are also employed in Ponnier monoplane, fastest machine in existence. Wing warping of Nieuport now accomplished by hand lever instead of foot bar. One model is armored and carries a mitrailleuse. Usual chassis consists of central skid and two wheels connected by steel leaf spring axle, but scout chassis resembles Morane.*

MORANE. *One of the most popular machines in army. Fuselage tapers to horizontal knife edge at stern. There is no fixed stabilizing plane, but small tail fins are fitted on latest models. The two wheels of landing chassis are connected by an axle resting in angle formed by two pairs of converging struts. "Parasol" type monoplane also manufactured. In this model plane is over occupants' heads improving downward vision. Observer can also see upward as rear of plane is cut out.*

HENRY FARMAN. *Pilot sits in bow, passenger behind him, both well ahead of leading edge of planes. Larger models have nacelle mounted on lower plane, but new scouting model has nacelle flush with upper plane. Center of gravity is thus very high, although lower plane has only 13 foot spread. Chassis is elementary, consisting merely of a wheel mounted at each end of lower plane. On larger models two sets of coupled wheels and short skids are used. Tail booms form a V as seen in plan.*

MAURICE FARMAN. *Contrary to usual practice Renault V-type motor drives geared-down propeller. Nacelle mounted between planes so that line of thrust passes through center of gap. Upper plane has considerable overhang. Tail booms on each side meet at empennage. Twin rudders surmount monoplane tail, angle of incidence of which can be adjusted.*

R. E. P. *Heavy, strong, and rather slow. Fuselage, of pentagonal section forward and triangular section in rear, is constructed entirely of steel tubes welded together. Tail plane to which elevator flaps are hinged is mounted flush with top of fuselage. Large tail fin renders machine very stable spirally. Steel chassis consists of two independent wheels and central skid.*

AVRO. *Original fuselage tractor biplane. Newest models have staggered planes set at slight dihedral angle. Top of fuselage is fitted with turtle back. Chassis is composed of two wheels and central skid modeled after Nieuport. Balanced rudder is mounted between elevator flaps. A single-seater with back swept planes and a "pusher" type biplane similar to Grahame-White are also made.*

BRISTOL. *Rectangular fuselage is stream lined above and below. Planes are of peculiar section, being flat on upper surface between main spars. Tail plane on two-seater is set at negative angle, on single-seater it is parallel with line of flight. Rudder of large model is placed above undivided elevator. Chassis consists of four struts carrying two skids from which are sprung four wheels. Single-seater has two-wheeled chassis, staggered planes and divided elevator.*

GRAHAME-WHITE. *Resembles H. Farman practice except that four-bladed geared-down propeller is used instead of direct driven type. Simple two-wheeled chassis is used. On top of stabilizing plane is small fin supposed to counteract side area of nacelle, but it is too near main planes to have much effect.*

VICKERS. *Passenger occupies front seat instead of being seated behind pilot as in Grahame-White. Tail booms are longer. Chassis consists of a couple of skids and wheels attached to a tubular axle. Ailerons are fitted to upper plane only, which has considerable overhang.*

R. A. F. *Lower plane is set at a dihedral angle which, with good weight disposition, gives a certain amount of inherent stability. Chassis consists of two long skids attached to fuselage by four struts. Axle carrying two wheels is slung from skids by rubber shock absorbers. Observation is not very good as passenger sits behind engine hood between planes. A 120 horse-power Austro-Daimler engine drives a four-bladed tractor through gearing.*

SOPWITH. *Speed range from 36 to 92 miles per hour with pilot, passenger, and fuel for three hours. This with an 80 horse-power Gnôme. Chassis is similar to R. A. F. on smaller scale. Rectangular fuselage with turtle-back tapers to vertical knife edge at stern post to which is hinged balanced rudder. Pilot and passenger sit side by side, former being on left. Top plane is staggered forward 1 foot and has slightly greater angle of incidence than lower.*

SHORT. *Follows orthodox lines, but is larger than most British machines. Ailerons are attached only to upper plane, which has considerable overhang. Lower plane has Blériot shaped tips. Passenger and pilot sit in tandem, pilot to rear. There is no vertical tail fin, but empennage is placed well to rear. Chassis is composed of wheels and skids. Short Brothers with Sopwith are also noted as most successful manufacturers of seaplanes.*

Improvised Means of Crossing Rivers

Some Examples of Military Resourcefulness in Emergencies

THE crossing of streams during military operations is commonly effected by the use of trestle or ponton bridges built by the engineer corps. But in time of war it often happens that the services of the engineers are not to be had, and a detachment of cavalry, infantry, or artillery is obliged to cross a stream by any means that it can find. In France the infantry is skilled in constructing light bridges or footways upon barrels, or upon trestles, consisting of light poles driven into the river bed. Again, the men often have to cross streams upon improvised floats of various kinds.

Barrels can be very well used as a base for the bridge platform by lashing a number together in the shape of a raft. The best way is to use two ranges of barrels placed end to end, the raft thus being two barrels wide and half a dozen or more in length. Such a raft is held together by a timber framing 6 feet wide and 25 feet long. Then the rest of the bridge is laid in the manner of the usual raft bridge.

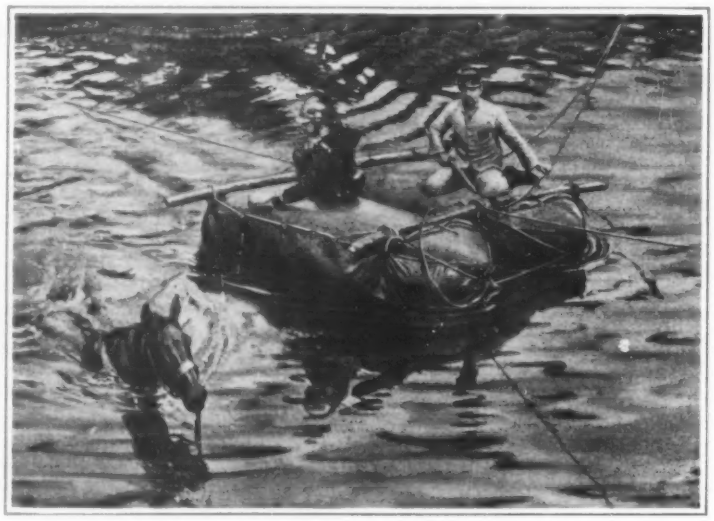
Trestle bridges can be constructed in a variety of ways, using either small tree trunks or other light timber, poles and the like, and each trestle has from 2 to 4 feet or uprights planted in the stream. When the stream is a shallow one, a practical and rapid method is to place wagons or carts in the stream for the supports, anchoring them in place with large rocks, and then running the bridge platform across them.

A good method of building a light foot bridge for infantry is to use standard army sacks filled with straw so that the sacks act as floats, and when laid close together they will support the planking for the footway. It is difficult to estimate the time required to build these different bridges, but for the footway run upon trestles three quarters of an hour is usually allowed for putting up a section 12 feet long upon four-pole trestles. Crossing of streams by cavalry is often done by even more primitive methods, and the troops are frequently put through exercises of this kind in order to have them well trained when it comes to emergencies. Should the horse be a good swimmer, he can carry the rider bodily across, but it is considered more prudent to let the horse swim alone, while the man also swims across. Non-swimmers go across upon rafts made up of tree-trunks or army sacks stuffed with straw or hay, these being hauled across the stream by ropes. On the raft is also placed the harness of the horses, as well as the men's clothes, assembled in packets. Untrained horses can be guided in tow by the men seated on the improvised raft, while the trained horses easily swim across without any attention. Usually the horses act with intelligence under such circumstances and the whole troop keeps together in good order.

Fording of streams is one of the most usual means employed for crossing, but of course this is limited to the smaller or shallow streams, and fords are very frequent here. For infantry crossing, a ford is practicable when the water is not over 3 feet deep, or 2 feet 6 inches, should there be a rapid current. Cavalry can cross at depths of 3 feet 8 inches, and vehicles at 3 feet to 2 feet 6 inches, should the river bed be solid and not muddy. In all cases it is the practice to run a hand rope across the ford upon poles. French troops have become quite accustomed to these maneuvers, and during the regulation army drills the chiefs lay out plans so that the men must cross the stream by swimming or otherwise, and once the habit is acquired, the troops have not the slightest hesitation to taking the water.

In the Austrian army special sacks of waterproof fabric are provided which can be blown up with air by simply using the mouth. These serve as pontons for light foot bridges. The sacks are said to answer all that is required of them in the way of floats, and do not suffer damage through use. An advantage in the use of this material is that the sacks are very light and can be carried on any kind of conveyance. On this plan, each regiment of infantry may be accompanied by enough material for laying out a 100-foot bridge, and this by using only one wagon, so that in actual war operations the army train would hardly be increased and the regulation engineer train would not be needed every time a small stream had to be crossed.

In the German army folding boats are made of canvas with improvised means for keeping them distended.



Bags of straw used as a raft by the French cavalry.

The accompanying photograph shows how cavalry lances are used for the gunwales and also as paddles to propel the craft. Three of these boats lashed together will carry an army wagon. The canvas boats may be folded up and packed on a horse.

Fatalities at Coal Mines During 1914 Compared With Previous Years

IT is gratifying to note that the fatalities in coal mines in the United States in 1914 were 334 less than during the preceding year, the total number being 2,451, as compared with 2,785 for 1913.

The principal causes of accidents that show a material decrease were coal-dust explosions, 96 per cent; haulage, 11 per cent; and falls of roof and pillar coal, 10.6 per cent. The net decrease, in underground fatalities, was 365, or 14 per cent. This is equivalent to saving one life every day during the year.

There were 331 fatalities due to gas explosions as compared with 91 in 1913, making a net increase of 240. Of the total gas-explosion fatalities, 261 were due to four serious explosions. There were slight increases in accidents due to explosions and electricity. There was also a net increase of 26 fatalities in shaft accidents, or 42 per cent, while on the surface the net increase was five, or about 3 per cent. The net decrease for the year for both underground and surface accidents at coal mines as compared with 1913 was 12 per cent.

The exact figures for the number of men employed are not yet available, but taking the estimates as furnished by the inspectors for part of the States and using the same number of men as employed in 1913 for the other States, gives an estimated total number of employees for the year as 742,868, as compared with 747,644 in 1913. The fatality rate, therefore, becomes 3.30 per 1,000 men employed in 1914, as compared with 3.73 in 1913.

Excluding 1912, when the rate was 3.27 per 1,000 men employed, the 1914 rate of 3.30 per 1,000 is lower than any year since 1903.

While there was a reduction of 12 per cent in the number of fatalities, there was also a reduction of 10.5 per cent in the production of coal. The United States Geological Survey estimates the production for 1914 as 510,000,000 short tons, as compared with 570,048,125 tons for 1913. The fatality rate per 1,000,000 tons of coal produced in 1913 was 4.89, and in 1914, 4.81. With the exception of 1912, when this rate was 4.41, the 1914 rate is the lowest yet recorded for the United States. The amount of coal produced per fatality in 1914 was 208,078 short tons, which, with the exception of 1912, is the largest on record. The production per fatality in 1913 was 204,685 tons; 1912, 226,469; and in 1907, 144,325 tons.

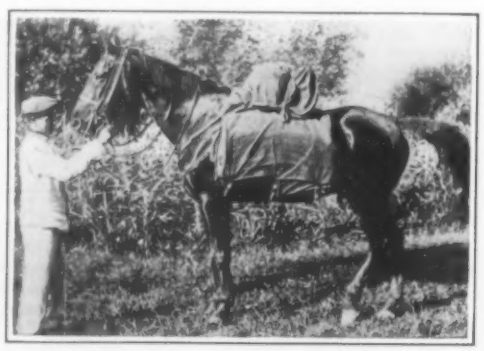
There were 316 lives lost in disasters in which more than five men were killed at one time, as compared with 464 in 1913, a net reduction of 148, or 32 per cent, in this class of accidents.

It is not possible to attribute these lower rates to any one particular influence. They may, however, be assigned in part to any one of the following agencies or to a combination of all of them: Closer and more careful inspection by the State inspectors; better enforcement of laws and regulations by the operators; realization of the dangers attendant upon the miner in his daily work and his efforts to reduce accidents due to the educational campaign conducted in his behalf; the extended use of safety lamps in doubtful mines; the use of permissible explosives; humidifying dusty mines; first-aid and rescue training, which saves lives that might otherwise be lost by reason of injuries received; the enactment of industrial accident compensation laws; and, last but not least, the spirit of co-operation on the part of all concerned.

Improving the Race by Early Marriages

IN the various discussions of means for improving the human race one of the ideas propounded is that our "superior" man, that is superior mentally, should marry at an earlier age so that four generations might be produced in a century, even at the expense of delayed efficiency. The result of such system, it is pointed out, would be that at the end of the century two thirds of our population would be of the twenty-five year stock, and all presumably in comparison with previous generations produced at the rate of three generations or less to the century. To such theories exceptions have been taken by many, and in order to develop definite facts, Casper L. Redfield of Chicago, who maintains that early marriages that result in rapid generations lead to conditions that produce mental and moral defectives, offered last April to donate $100 to the American Genetic Association if it could be shown that any superior individual was ever produced by breeding human beings as rapidly as four generations per century; and considering the exceptionally great man of history he offered a second hundred dollars if a single one of them could be shown to come in the three generation class. Recently the association returned to Mr. Redfield the money he had deposited, no one having met the conditions announced.

Ferrying a wagon on folding canvas boats.



Folding boats packed on a horse.

Crossing a river on an improvised catamaran.

Random Reflections

By "Irresponsible"

I MET a man a little while ago, an artist, writer, and one-time engineer, who informed me that there were no first-class minds in any of the arts to-day; they had all been absorbed by the sciences. This is one of those statements whose implications are more interesting than its assertions. Of course, on the face of it, it is open to several objections. We may deny that there are no first-class minds in art; or, admitting their absence, we may deny the existence of any first-class minds in science. Understanding by first-class, men of the Faraday, Darwin, Maxwell, Kelvin level, without ascending to world-shaking prodigies like Isaac Newton, we may very well ask what first-class minds exist in science at the present day. The late French mathematician, Henri Poincaré, was undoubtedly first-class—still, he is the *late* Henri Poincaré. Who else is there?

The average level of intelligence among scientific men at the present day is distinctly high, rather higher, perhaps, than the level among artists. And, to go off on a side issue for a moment, I had received the personal impression from my acquaintance with both artists and men of science, that on the whole the scientific man had a stronger character. He seemed to me calmer and better balanced. But since this war started (I knew the war would crop up somehow) I've become doubtful. Some of these frantic German professors! For instance, a celebrated professor at Heidelberg, a man whose work I have long admired, and who has trained English students by the score, advocates the destruction of Westminster Abbey, together with the tombs of the great dead of England. It reads like hysteria; where is the calm well-balanced character, elevated and fortified by a life-long devotion to science? And his voice is not the only one. There are enough of them to form a chorus.

I am afraid that scientific men have degenerated. About one hundred years ago another big war was raging, but it was between France and England. While it was going on the French Academy of Sciences bestowed a medal upon an English scientific man for his distinguished services to science. One cannot help admiring that. That is exactly the attitude which becomes a scientific man, and which dignifies science. We must preserve that spirit. We must have a few men who remember first that they are members of a collection of curious little two-legged animals without feathers, called the human race, and only secondly that they happen to exist on some particular corner of the planet earth, that common dwelling place of all their kind. An excessively patriotic man, like an excessively anything else, is merely a man with a defective sense of proportion. And a defective sense of proportion is—well, it's a pretty generally accepted definition of lunacy. But that is a side issue. I was talking about the arts and sciences. I don't think it can be shown that first-class minds at the present day take up science rather than art. As I have said, I am, to start with, a little doubtful about the existence of the first-class minds. But letting that pass, and supposing that by analyzing the psychology of a scientific man's work one can show that he is a really, in temperament and intimate mentality, an artist. Suppose he is invariably interested, not in the results he obtains, but in the beauty of the methods by which he obtains those results. Roughly speaking, that would be different from the scientific mind as it is generally understood. Well, I think there are such scientific men. But I think there are quite as many artists who are more interested in results than in beauty. Take a writer like H. G. Wells. He is particularly interested in writing novels which illustrate the influence of social surroundings upon various characters, including in social surroundings other human beings. In any particular case such an investigation is scientific in character, and in reading Mr. Wells one certainly gets the impression that he is much more interested in conducting that investigation faithfully and vividly than he is in producing a finished and beautiful piece of literature. He is distinctly more interested in what he is saying than in the manner in which he says it. He is a scientific man using as his medium the novel rather than the psychological or sociological treatise.

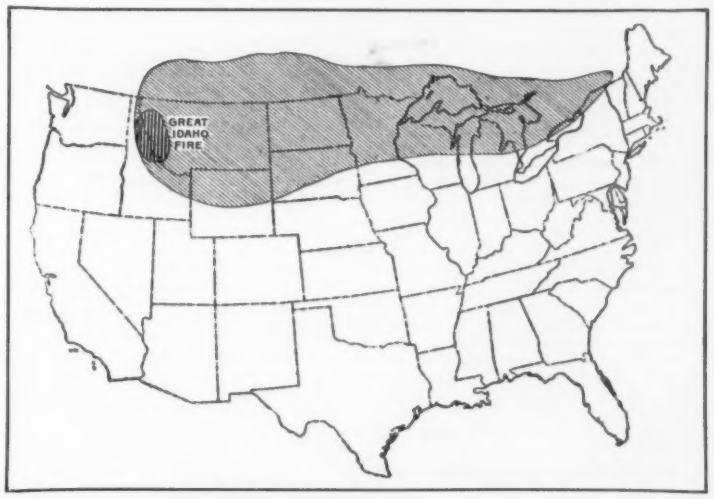
Mr. Wells does not stand alone. Various other names could be mentioned. Personally I think this extension of the scope of the novel a highly important and desirable phenomenon. Scientific investigations can be presented in the form of a novel which could not be effectively presented in any other way. Before a sound scheme of society can be built up we must know an immense amount about personal and social psychology. Besides the professor, we require for the proper investigation of these two subjects the man of insight and imagination. We require the novelist. Because his methods are, in a way, looser and more general, they will probably prove more valuable. And, a little fact not without its importance, he can influence an incomparably greater public. So that, in view of the existence of this kind of novel, and of one or two other indications of a similar kind, I should feel disposed to say that artists and men of science share the arts and the sciences pretty equally. To some extent the two things merge into each other. There are stylists in science. To me, for instance, there is some resemblance in style between the work of Abel, the Norwegian mathematician, and that of Chopin, the Polish musician. But I admit that I experience difficulty in making the resemblance clear to other people.

Dark Days and Forest Fires

By C. F. Talman

INSTANCES of daytime darkness are recorded in the old chronicles along with such other "prodigies" as multiple suns, showers of blood, and warring armies in the sky—all of which can easily be identified to-day with well-known meteorological phenomena (parhelia, rain reddened with desert dust, and the aurora). The two famous cases mentioned in the Bible—the plague of darkness in Egypt and the darkness attending the crucifixion—illustrate the fact that such occurrences were once universally assumed to be miraculous.

Some of the early cases of daytime darkness mentioned in history are doubtless attributable to solar eclipses, and must, accordingly, have been restricted to a small part of the earth's surface, and have been of but a few minutes' duration. The majority of the famous "dark days" were, however, the result of an abnormal accumulation of smoke or dust in the air, sometimes arising from burning forests, moors, or prairies, sometimes from volcanic eruptions, and in many instances covering vast areas of the globe.



Area in which dark days occurred, caused by smoke from the great Idaho fire, August 20th to 25th, 1910.

In a recent publication on "Forest Fires" (*Forest Service Bulletin 117*), Mr. F. G. Plummer gives the following list of dark days in the United States and Canada:

1706—May 12th, 10 A. M., New England.
1716—October 21st, 11 A. M. to 11:30 A. M., New England.
1732—August 9th, New England.
1762—October 19th, Detroit.
1780—May 19th, New England. (Black Friday. The Dark Day.)
1785—October 16th, Canada.
1814—July 3rd, New England to Newfoundland.
1819—November 6th to 10th, New England and Canada.
1836—July 8th, New England.
1863—October 16th, Canada. ("Brief duration.")
1868—September 15th to October 20th, Western Oregon and Washington.
1881—September 6th, New England. (The Yellow Day.)
1887—November 19th, Ohio River Valley. ("Smoky Day.")
1894—September 2nd, New England.
1902—September 12th, Western Washington.
1903—June 5th, Saratoga, N. Y.
1904—December 2nd, 10 A. M., for 15 minutes, Memphis, Tenn.
1910—August 20th to 25th, Northern United States, from Idaho and Northern Utah eastward to St. Lawrence River.

Forest fires are the common cause of dark days in this country. The fact that such days are most frequent in the Northeastern United States and Eastern Canada is evidently related to the fact that practically all barometric depressions ("lows"), with their attendant whirl and indraft of the surface air, pass down the St. Lawrence Valley on their way to the ocean, and usually become intensified and sharply defined in this region. The smoke from a conflagration anywhere on the periphery of a "low" is drawn into the vortex along more or less converging lines, and at the same time rises to a considerable altitude. Eddies in the circulation of the "low" will result in a dense accumulation of the smoke in places, and this may occur above the level of the lower clouds, which thus mask the cause of the phenomenon. Hence the startling effect of darkness in the daytime, often with little or no turbidity of the air near the earth's surface. Mere smokiness of the air near the ground or a fog heavily charged with smoke (as in the case of the London fogs), however great the obscurity produced, would hardly be placed in the same class with the awe-inspiring dark days of the chroniclers. If, however, showers occur during one of these occurrences, a large amount of soot is likely to be brought down, and thus we have another "prodigy"; viz., "black rain." A very recent case of this sort is reported in the *Quarterly Journal of the Royal Meteorological Society* for October, 1912; during a thunderstorm in Eastern Hampshire darkness almost like that of night occurred in the early afternoon, and inky rain fell. The phenomenon was due to soot carried from London, fifty miles away.

When the pall of smoke is rather thin a certain amount of sunlight struggles through, and owing to the same process that gives us the golden glow of sunset a yellow or coppery tinge is cast over the landscape. This effect has been noted in connection with several dark days, including the most famous of all, that of May 19th, 1780. It was the principal feature of the dark day of September 6th, 1881, in New England, which is accordingly known as "the yellow day."

The great Idaho fire of August, 1910, was responsible for dark days over an area larger than in any other case on record in this country. The accompanying chart, from the *Forest Service Bulletin* above mentioned, shows the area in which artificial light was used in the daytime, but smoke was observed far beyond these limits. The British ship "Dunfermline" reported that on the Pacific Ocean, 500 miles west of San Francisco, the smell of smoke was noticed, and haze prevented observations for about ten days.

Restoring Fatigued Muscles

A VERY ingenious physiological method of increasing the yield of labor from any given group of muscles is described in the *Deutsche Revue*. According to an abstract in *Die Umschau*, the author, Th. Weber, claims that in practice a gain of from 22 to 40 per cent is obtainable in the amount of work done. The device is extremely simple. When the given group of muscles has reached the point of exhaustion, due to the accumulation of the products of fatigue, they are allowed to rest, while an entirely different muscle group is set to work vigorously. The energetic contraction of these muscles causes an increase in heart action and circulation, and the strengthened current of blood thus sent to all parts of the body partially restores the working power of the first group of muscles by carrying away fatigue toxins and supplying oxygen.

Automobile Fire Department Outfits

AN automobile fire engine of improved type was lately delivered by an English maker to Athens on the order of the Greek government. The present outfit, although very effective, is equipped with a 60 horsepower engine and turbine pump, but it is light enough to run on rubber-tired wheels. Another outfit produced by the same concern consists of an automobile hook-and-ladder supply car, seven of which are now in use by the London fire brigade. They are fitted with 30-gallon chemical tanks, hose reel and telescoping ladder, and are especially good for first aid work. It will be observed from the first-mentioned outfit that the rotary pump is coming into favor for fire engines. Such pumps are also in use on the Paris fire engines.

Darwin Relics.—The late William Erasmus Darwin, who was a son of Charles Darwin, recently left a number of relics of his famous father to his nephew, with the request that they be kept permanently in the possession of the Darwin family. These relics include the family portraits, many medals that had been presented to his father, the letters written home by him while on the "Beagle" expedition and two early sketches of "The Origin of Species."

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

CAP PROTECTOR.—Y. M. MARKS, U. S. Army, General Hospital, Presido, Cal. This invention has reference more particularly to the type of cap used in the U. S. Army, the crown of which, when the cap is worn, touches the head of the wearer, resulting in a solid spot on the cap. The invention provides a protector having an effective attaching means for the convenient and secure application of the protector to the crown of the cap, at the inside. The protector provides for holding a removable card or identification tag between the protector and the crown of the cap.

CAP PROTECTOR.

COMBINATION SHIRT AND VEST.—C. MARCUS, 580 Broadway, New York, N. Y. The invention provides a shirt with vest fronts or sections in such manner as to eliminate the necessity of wearing a vest separate and apart from the shirt and with an independent back, the invention more particularly residing in the construction of the vest fronts and ways and means for attaching the same to the vest.

GARTER.—E. B. WINTERS, 815 Union St., Coffeyville, Kansas. This invention provides a very comfortable garter, as the pressure due to the pad is well distributed, and the pad as a whole has an amount of resilience and yieldability conferred upon it by the spring, and adapted to equalize the pressure exerted by the pad upon the wearer's leg. Mr. Winters has invented another garter, having an inelastic band in which he locates the coil springs in line with the tension brought to bear thereon through the leg band, and said springs are also located at the point of greatest possible separation of the shield branches, whereby great latitude of garter expansion results, this being advantageous when a wearer bends his leg at the knee. This inventor has also invented another garter in which, while still employing the inelastic bands, bifurcated shield, and yoke-spring, the spring arms are firmly secured to the shield, one end of the band is permanently secured to the shield, and the other end thereof is in detachable connection with the shield.

CONVERTIBLE GARMENT.—AMELIA B. WELLS and MATILDA BLICKHAN, 121 W. 88th St., New York, N. Y. The object of this invention is to provide a convertible garment more especially designed for woman's wear which can be readily converted by the owner into a house dress, empire gown, street dress, ball-room dress, belt waist dress, and loose back wrapper.

MATERNITY SKIRT OR DRESS.—B. SCHIFF, 119 W. 25th St., New York, N. Y. The garment is open at the front and is provided with a waistband having non-elastic front portions and a gathered hem at the back, and draw strings in the said hem and secured at the middle of the back and extending out of the hem at the forward ends thereof, and a retaining means on the said front portions of the waistband and to which the outer ends of the draw strings can be tied.

LIFE PRESERVING SUIT.—W. J. KARRAN, R. F. D. No. 1, Bryant, Wis. The features of novelty are the construction of the mouth-piece and its side attachments controlling the admission of air to support respiration, and of means for clamping and tightly closing the openings in the legs and crotch of the suit, which opening is required to permit application of the suit to a person.

SHOE SHINING MACHINE.—F. V. MURPHY, 912 Franklin St., Bay City, Mich. This inventor provides a coin-controlled machine for polishing shoes, either black or tan, and wherein mechanism is provided for polishing the shoes, adapted to properly polish shoes of varying sizes, and wherein the mechanism is so arranged, that by inserting a coin of the proper denomination the polishing machine will be set in operation.

Electrical Devices.

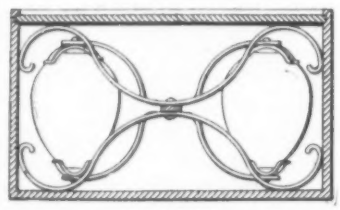
ELECTRIC FIRE ALARM.—W. E. HOWELLS, 743 Pleasant Ave., Peckville, Pa. This invention relates to an electric fire alarm of that type, including a heat responsive device, which at a predetermined rise in temperature of the atmosphere will close an electric circuit including one or more alarms or other warning devices.

METALLIC ELECTRIC WELDER.—W. H. DRALLE, 1010 24th St., Watervliet, N. Y. This invention relates to the art of electric welding, wherein the active electrode is a metal rod or wire which is so held that one extremity becomes the one element of the welding arc, while the other element is the work to be welded.

ELECTRIC IMPLEMENT.—L. PAULERO, Address American Electric Tool Co., Petersburg, Va. An object of the inventor is to provide a device especially adapted for cutting and carving stone, driving rivets, clipping and caulking, hammering, and, in fact, wherever it is desirable to employ a tool having a reciprocating motion.

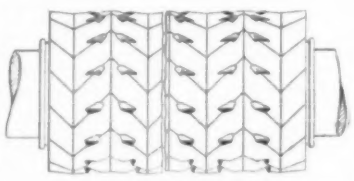
Of Interest to Farmers.

EGG CARRIER.—E. DUERR, 524 West St., Kensington, Brooklyn, N. Y., N. Y. This invention relates to improvements in egg carriers, and has for an object to provide a structure which will resiliently support eggs in a container. It provides a resilient support for eggs which will hold the eggs spaced apart and will press against the ends of the eggs, whereby the strain on the eggs is brought at their strongest point.



EGG CARRIER.

ROLLER.—L. G. G. DIBBETS, The Hague, Netherlands. The invention relates to improvements on the rollers used in the Krajewski crusher, which is utilized for crushing and cutting sugarcane before the same enters the ordinary three-roller mill. The Krajewski crusher is at the present time the most important and successful accessory designed to increase the efficiency and output of any form of cane-grinding plant to which it may be applied. This contrivance acts both as a crusher and as a preparer and equalizer of the feed of the cane as it enters the mill, and is now generally used in connection with the train of multiple mills.



ROLLER FOR SUGARCANE.

WOOL COMBING MACHINE.—T. H. FRIEND, care of American Woolen Co., Lawrence, Mass. In carrying out the invention a friction wheel in the form of an idler is mounted on a suitable supporting means which maintains the idler in engagement with the driving and the driven belt pulleys so as to cause an effective transfer of power, the supporting means being so designed as to be readily applied to the machine.

COMBINED POULTRY ROOST AND VERMIN TRAP.—G. WOODALL, 130 South Ave., Davenport, Iowa. The invention relates more particularly to that type in which the bars thereof embody traps for entrapping vermin that affect chickens and other poultry. It is well known that chicken lice and other vermin are in the habit of secreting themselves in small cracks in the roosts during the daytime when the roosts are unused.

VENTILATED CAN CLOSURES.—O. P. L. OLSEN, Box 274, Eugene, Ore. This invention relates more particularly to a cream can closure. One of the principal objects is to provide a can closure by means of which the contents of the can may be ventilated without danger of the admission of mice or other animals or insects into the can.

SUPPORT AND PROTECTOR FOR FRUIT BEARING TREES.—W. R. WINANS, Winans City, *via* Hood River, Ore. The netting conforms to the shape of the tree. The strands composing the netting come in contact with, and effectually support, the extremities of the limbs, and thus indirectly support the fruit attached to, and pendent from, such limbs; yet the netting does not interfere with the passage of light, air, or moisture, so that the ripening of the fruit proceeds the same as if the netting were not applied.

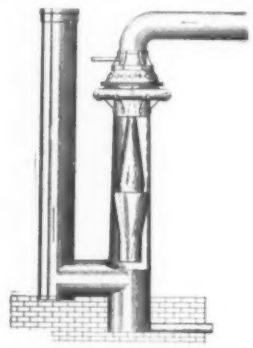
Of General Interest.

NURSING BOTTLE HOLDER.—I. REYMAN, 23 South Main St., Port Chester, N. Y. The invention relates to brackets for special purposes, and especially to brackets for holding nursing bottles in connection with infants' cribs, cradles, carriages, or the like. The device may be readily clamped securely in any ordinary position in which it may be desired to be used.

COMBINED POST AND TENSION DEVICE FOR WIRE FENCES.—C. D. BENNETT, Scipio, Ind. This invention relates to wire fences and has for an object to provide a combined corner post and tension device adapted for either portable or stationary fences. By this invention the wires of a fence can be quickly secured in position and any desired tension given to them.

BOTTLE STOPPER.—A. MOTRONI, 74 Columbus Ave., New York, N. Y. This invention has reference to improvements in bottle stoppers, and has for an object to provide an improved structure which is adapted to maintain a bottle closed except during the time that fluid is being discharged therefrom.

SMOKE DISPENSER.—M. MOSER, care of General Delivery, Seattle, Wash. This invention relates to smoke dispensers of the type in which the smoke, formed in a furnace or analogous structure, is brought into contact with a liquid and thus prevented from being set free in the atmosphere. The inventor seeks to provide a dispenser adapted for general use, but of peculiar service in connection with smelting furnaces and other analogous devices, and so arranged as to bring the smoke into contact with water under such conditions as to cause the smoke to be absorbed by the water.



SMOKE DISPENSER.

STIRRUP.—G. D. COOLER, Waynesboro, Va. In this case provision is made for flexibility and springiness while riding, in order to reduce sudden shock, and the object of the invention is to provide such an arrangement and means by which the play or flexibility of the parts is limited in order to prevent their excessive action when mounting.

SEAL.—J. KLEIN, Box 49, Route No. 2, Tampa, Fla. This seal is for use on trunks, suit cases, and articles of a similar nature. The invention provides a seal which is capable of quick and easy manipulation, and which will hold the article to which it is attached firmly locked and secure against undetected tampering.

LOCKING RECEPTACLE FOR MILK BOTTLES.—C. NAHABEDIAN, 445 E. 179th St., Bronx, N. Y., N. Y. The invention provides a receptacle having a lock which may be operated to release only when removed from the station in which it is placed; provides a receptacle, the mechanism whereof is simplified to reduce the cost of construction and avoid disarrangement; and provides a receptacle having facilities for carrying bottles in locked position.

PROCESS FOR PRODUCING PERFORATED TUBULAR ELECTRODES FOR ACCUMULATORS.—J. KRANNICHFELDT, Cologne-Niehl, Germany. This invention comprises a process for producing electrodes for accumulators which consists in covering the openings of the tubes with paper on the inside of the tube, filling said tubes with active mass, hardening said active mass and accelerating the destruction of the paper by filling the accumulator formed by said tubes with a strong acid.

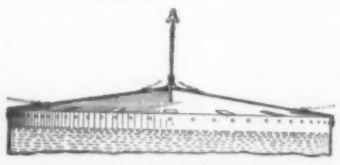
HIGH FREQUENCY THERAPEUTICAL APPARATUS.—F. M. KIDDER and M. H. KIDDER, 820 Broadway, New York, N. Y. This invention provides a handle for the apparatus with a flexible supply cord, the handle having novel means on its ends whereby the cord when not in use can be wound around the handle lengthwise thereof, whereby the wire is prevented from kinking or becoming entangled.

PROPELLER.—C. T. A. H. WIEDLING, 124 26th St., Guttenburg, N. J. The invention relates to rotary propellers for ships, balloons, flying machines and similar vehicles, and it is also of equal usefulness for other devices and machines like turbine motors for steam, water, wind, air or gas power, or like turbine pumps, turbine air compressors, blowers, and fans.

LIQUID DISTRIBUTING DEVICE.—C. RISACHER and P. A. HÉBERT, 58 Boulevard Pasteur, Paris, France. The device according to this invention consists of a tube connected with the source of the supply of liquid and on which are branched lateral ajutages or spouts, in combination with a porous or fibrous material, such as wicks, which fill the bore of the tubes and spouts. The device can distribute any sort of liquid.

COMPOUND BINDING STAY.—H. DE HAVEN, 52 Columbia Heights, Brooklyn, N. Y., N. Y. The improvement provides a reinforcing stay more especially designed for use on light wooden packing boxes and like receptacles, and arranged to permit of quickly and conveniently attaching the stay to the box without the use of a large number of nails or similar fastening devices.

OIL TANK.—E. A. WASSON and F. M. COOLEY, 566 Crockett St., Beaumont, Tex. This invention provides an oil tank with means for allowing the escape of exploded gases, when the gases are ignited by lightning or other sources. It provides an oil tank having outlet valves, and means for causing the explosion of the gases contained within the tank upon lightning striking near the tank, the valves being adapted to open to allow the escape of the explosive gases, and then to shut whereby to cut off the supply of air, thus smothering the fire.



OIL TANK.

BOTTLE ATTACHMENT.—J. B. CLAYTON, 1025 Hillen St., Baltimore, Md. This attachment is adapted for connection with the neck of a bottle, especially those containing poisonous substances, and having means for encircling the stopper of the bottle to prevent the removal of the stopper without striking the attachment to warn the person holding the bottle concerning its contents.

DISPLAY APPARATUS.—C. BOUDREAUX, Marathon, Tex. The improvement provides an apparatus especially adapted for holding articles packed in independent boxes, in such manner that any particular box will be accessible for examination or removal without changing the position of any other than the box to which access is desired.

Hardware and Tools.

CROSSCUT SAW.—R. W. GRAVES, 900 East Jersey St., Elizabeth, N. J. This saw is especially designed for cross-cutting purposes, such as felling trees, sawing felled trees into the desired length, sawing lumber and the like, and arranged to allow convenient and quick adjustment of the saw blades for sawing work of different diameters, to cut the work by two blades from opposite sides, and to hold saw blades with the desired tension in engagement with the work without pressure on the part of the operator.

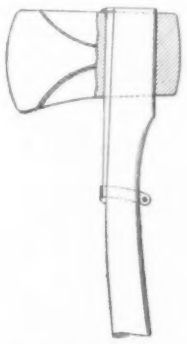
HOSE PIPE COUPLING.—H. R. VAN METER, 1163 E. 12th St., Los Angeles, Cal. This invention provides a means for coupling hose-pipe sections or hose-pipe and plugs provided in water supply systems; provides means for rapidly connecting said sections or sections and plug; and provides means, automatically adjustable, to accommodate couplings of different sizes or conditions.

MOP WRINGER.—W. H. WELCH, Alba, Mich. This invention relates to means for forcing water out of mops, and it accomplishes this result by squeezing the entire mop at one time, rather than by drawing the same between rollers, or by twisting the same, whereby no injury occurs to the mop. The mop is easy to operate and the wringing efficiency is remarkable, even up next to the handle. It can best be made out of stamped steel.

SHOWER BATH BODY.—F. BOCKELMAN, 162 East End Ave., New York, N. Y. The object of this invention is to improve the construction of what is known in the trade as a shower bath body, whereby the same is not only rendered more neat and graceful, but is of superior strength and lasting qualities, said structure being made preferably of a unitary or one piece casting, whereby unnecessary joints which tend to weaken the device are avoided.

GAGE FOR HINGES.—J. F. GODEFROY and A. J. KUGLER, 210 W. 146th St., New York, N. Y. An object here is to provide a universal compact gage or tool by means of which holes to be drilled in the object to be hinged will direct the drilling tool at a proper angle to the face of the object and give the required distance between the drilled holes.

HANDLE PROTECTOR.—J. HOLIK, 602 East Crocket St., Ennis, Tex. The invention relates to improvements in devices for protecting handles of axes, hammers, and other similar tools. The main object is to provide a device for protecting the handle of a tool, such as an ax, and for stiffening it at its weakest point. The invention provides means for preventing the head from flying off the handle.



HANDLE PROTECTOR.

Heating and Lighting.

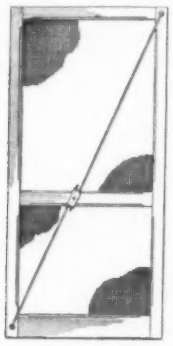
CANDELABRUM.—D. H. LIND, care of Morris Wolf, 302 Broadway, New York, N. Y. The invention provides a candelabrum having the candle holders provided therefor, constructed without the use of materials which melt or are otherwise deleteriously affected by heat; provides means whereby the holders commonly employed for supporting candles may be converted into holders for wicks; and provides reservoirs or receptacles for oil to be supplied to said wicks.

Household Utilities.

PORTABLE CLOTHES REEL.—J. T. PILKINGTON, R. D. No. 4, Armstrong, B. C., Canada. The design in this case is to provide a reel in which the several arms may be revolved separately or in unison; in which the respective arms may be turned to bring them into vertical alinement whereby the reel may be run through a doorway or be conveniently placed on a veranda or in compact form adjacent to a building.

Household Utilities.

BRACING DEVICE FOR SCREEN DOORS.—P. CHRISTENSEN, 501½ E. Washington Ave., Argenta, Ark. The invention provides a device which can be made at small cost and which will effectually brace the door without adding materially to the weight thereof. It provides a device which may be adjusted to doors of different sizes, since it is provided with means whereby the bracing device may be



BRACING DEVICE FOR SCREEN DOORS.

lengthened or shortened within limits. In this device the bracing of the upper and lower portions of the door may be independently effected.

OVERLAP SHOWER RING.—G. F. COLTER, 419 W. 119th St., New York, N. Y. The ring is provided with an overlapped portion. This may be connected or separated as desired, but must overlap to such an extent as to allow a curtain to present a substantial overlap for entirely closing the opening. The ring may be supported by any suitable standard, and may have a spraying device associated therewith of any desired form. The entire outfit may be arranged above a bath tub or other suitable place.

Machines and Mechanical Devices.

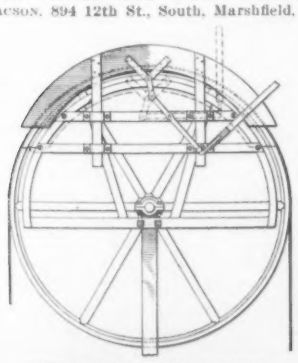
DROP HAMMER.—R. GROSDIDIER, Société Anonyme des Forges et Aciéries de Commercy, Commercy, Meuse, France. For the purpose of avoiding many inconveniences, the present invention consists in providing a disconnection, no longer by the direct action of the mass on the clutching device on the arrival of such mass at the top of its throw, but by the action of an auxiliary clutching device which acts in antagonism to the usual clutching device, and which is more powerful than the latter, such auxiliary device being trussed and locked in position during descent of the mass and then released by the latter on its return to the top of its throw.

ROAD BUILDING MACHINE.—J. H. MOORE, JR., 149 Pioneer St., Brooklyn, N. Y., N. Y. This invention provides a machine arranged to continuously mix and deliver road-building materials; provides a machine for manually controlling the distribution; provides such a machine with self-contained traction mechanism; provides means for supplying the machine with raw materials; and provides means for measuring the raw materials for mixing.

DEVICE FOR DELIVERING TOBACCO TO CIGAR AND OTHER SIMILAR MACHINES.—E. BELOT, 319 Rue de Charenton, Paris, France. In the present patent the invention has reference to devices for delivering tobacco cut up into short and dry lengths to form the interior of machine-made cigars, or for supplying material to any other similar machine.

CAN TOP DROPPER.—C. E. FORRY, care of H. L. Guenther, 310 North Ave. 19, Los Angeles, Cal. In the present patent the object of the inventor is the provision of a simple, economical, and efficient device for dropping can tops one at a time and delivering them to any suitable feeder for feeding them mechanically to a can topping machine or the like.

SAW GUARD FOR BAND MILLS.—A. ISAACSON, 894 12th St., South, Marshfield, Ore.



SAW GUARD FOR BAND MILLS.

This invention is an improvement in saw guards and catchers for band mills, and has for its object to provide a device capable of adjustment for various conditions, and wherein mechanism is provided for catching the saw should it run off the band wheel, and for preventing the running of the saw into the saw pit, to prevent damage to the saw, and to safeguard the sawyer.

CONVEYER.—J. J. PHILLIPS, Brookhaven, Miss. The invention provides a conveyer more especially designed for carrying clay or similar materials from a receiving hopper to a dry pan, and arranged to permit convenient arrangement of the amount of the material to be delivered to the dry pan according to the condition of the material at the time.

MAIL BOX.—C. E. UTTERBACK, Lock Box 201, Mooresville, Ind. The more particular purpose in this case is to provide a device having improved means for safe-guarding mail placed in the box. The box constitutes a safe repository and one which may be easily and quickly opened and closed. Mail placed therein will be cared for and held so that when the main door is lowered and supported, the mail may be readily withdrawn.

COAL LOADING DEVICE.—W. W. JAMISON, Greensburg, Pa. An object here is to provide a device having a movable chute which may be thrust forward into the loose coal, and means for elevating the latter into the car. A further object is to provide means for permitting the swinging of the chute to one side or the other without interfering with its forward and backward movement, thereby increasing the range of operation of the chute.

Musical Devices.

COMBINATION DRUM AND CYMBAL BEATER.—J. HUBMANN, 2255 South Jefferson Ave., St. Louis, Mo. This invention relates to a combination drum and cymbal beater and has for its object the provision of a contrivance of

COMBINATION DRUM AND CYMBAL BEATER.

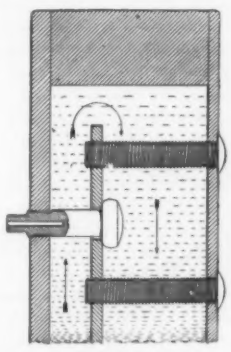
this character by which a drummer seated can play a bass drum and cymbal with one foot, leaving his hands free to play a snare drum or other effects or instruments necessary for an up-to-date trap drummer.

PEDAL ACTION FOR PLAYER PIANOS.—C. H. LADEW, SR., 1879 Clinton Ave., Bronx, N. Y., N. Y. This improvement provides a pedal action for player pianos, arranged to control the hammer rail of the piano action in the usual manner when playing the piano by hand, or to permit of actuating the bellows from the same pedals when using the instrument as a player piano.

Prime Movers and Their Accessories.

INTERNAL COMBUSTION ENGINE.—C. STIRIZ, 2577 8th Ave., New York, N. Y. The invention relates to internal combustion engines, the more particular purpose being to provide such devices with an improved water jacket in which the water is caused to circulate by the conjoint action of centrifugal force and difference in density between hot and cold water.

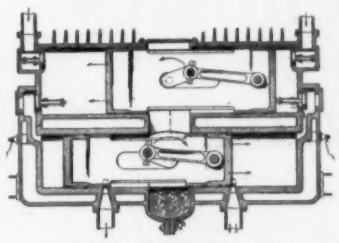
STAY BOLT.—D. J. O'BRIEN, Box 1002, Jerome, Ariz. The invention refers more particularly to the flexible type of stay bolt associated with a partition in the boiler for perfecting the circulation of the fluid to be heated.



STAY BOLT.

It provides a stay bolt and partition of simple, strong, and durable construction, which bolt has means for readily indicating any injury thereto, and which will insure at all times a universal tensile strength.

INTERNAL COMBUSTION ENGINE.—T. I. A. TOMASINI, Cayucas, Cal. This inventor provides a device which has a plurality of cylinders, and in which the explosions take place in regular succession. He also provides a novel form of device in which there is an auxiliary



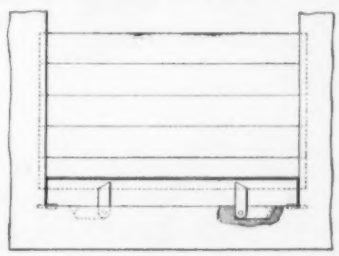
INTERNAL COMBUSTION ENGINE.

compression cylinder for each explosion cylinder, the compression cylinder not only acting to compress the charge preparatory to firing the same, but also acting as a compression means for the efficient scavenging of the cylinder after the explosion has taken place.

Railways and Their Accessories.

KILN CAR.—C. E. EVANS, Weed, Cal. The car has a movable stake connected by links with a stake secured to the body of the car, one of the car wheels being journaled to a lever fulcrumed to the car body, and this lever engaging a member at the bottom of the movable stake, so that the weight of the material on the body will serve to move the body down relatively to the lever, thereby moving the movable stake relatively to the stake secured to the body, for pressing the lumber against another stake.

GRAIN CAR DOOR.—W. B. NICOLL, care of W. L. Morton, Fort William, Ontario, Canada. The invention relates to grain cars used for transporting grains of varying kinds. Among the advantages of this invention are: 1. To simply use the threshold plate or toeplate (which is on every car) as a sure and efficient grain-release. 2. It does not matter in which way the door above the plate is adjusted, as it



GRAIN CAR DOOR.

is bound to come out intact when the pressure of the grain is taken from behind it on letting the plate down. There is no excuse whatever to destroy the door. 3. It places in the hands of the railway companies a means of release in permanent connection with their cars which puts them in a position to demand damages for any injury to their doors in the process of unloading grain. It is easier to let down the plate than to break through the door.

RAILWAY TIE.—T. M. DANIELS, 327 South La Salle St., Chicago, Ill. This invention relates to railways, and the object thereof is to provide a tie for the tracks which not only positively maintains the tracks in relationship with each other, but which also support the tracks in a yielding or resilient manner.

AUTOMATIC TRAIN STOP.—F. G. BASZIAN, 62 Bloomfield Ave., Buffalo, N. Y. The invention provides means for releasing the air in the train line of the brake system, to reduce the pressure in the train pipe for applying the brakes, by partially exhausting the air into an exhaust reservoir instead of directly into the atmosphere, whereby the pressure in the said reservoir and train pipe will be equalized after the brakes have been applied and the train stopped.

RAIL JOINT.—T. B. STROTHER, Catherine, Ala. This improvement provides means for connecting abutting rail ends, wherein the connection is so arranged that it will rigidly support the rail ends in alinement and in register, and wherein the connection will also prevent creeping of the rails with respect to the ties.

Pertaining to Recreation.

SCREEN FOR MOVING PICTURES.—J. H. GENTER, Newburgh, N. Y. The invention relates to screens for receiving and projecting images, such as those of stereopticons or moving picture machines. An object is to provide a screen which is actually made up of a series of strips, but which appears to be a unitary structure without any screens. The screen will not subject the eye to strain, glare, or haze.

AMUSEMENT APPARATUS.—W. F. MANGELS, Coney Island, Brooklyn, N. Y., N. Y. This invention relates to an amusement device adapted for popular resorts and is of that type in which passengers ride in a car which has a predetermined motion tending to produce amusement and merriment for the occupants and spectators.

Pertaining to Vehicles.

ATTACHMENT FOR STEERING WHEELS.—V. A. ASPLUND, Glenburn, N. D. The invention relates to a hand rest or gripping attachment applicable to the periphery of a steering wheel, to afford positive abutments or resistance members to prevent the operator's hand from slipping on the wheel, and to enable him to obtain a better grip.

AUTOMATIC ENGINE SPEED GOVERNOR FOR VEHICLES.—T. DOUGLAS, 80 Maiden Lane, Scarboro, N. Y. This invention relates to engine governors of the automatic type and adapted to be used between the throttle and inlet or inlets of an engine and operatively connected with the speed shaft of the engine or some moving part of the machine driven thereby, or with both, whereby the speed will, when excessive speed is attained, cut down the supply of elastic or explosive fluid to the engine for controlling the speed thereof.

POWER TRANSMISSION MECHANISM FOR AUTOMOBILES.—M. L. SENDERLING, 333 Fairmont Ave., Jersey City, N. J. This invention provides means manually operable for positively and operatively connecting the two sections of a driving shaft which is normally operatively connected through a differential gearing; and a further object is to simplify the construction of the auxiliary connecting mechanism.

BRACKET FOR VEHICLE LAMPS.—L. E. GERRISH, P. O. Box 14, East Lebanon, Maine. This invention prevents accidents by throwing the light rays right or left as the car is turned, more quickly than rays of the lights in use get around. The lamps are clamped to the arm in front or back of the knuckle by an improved vehicle bracket that will fit any car. The pneumatic tires take up any vibration that is not needed to keep the lights free from mud, as they are placed under the mud guards, one on each side. The invention is adapted to electric side lights (torpedo type) only.

FRICTION DRIVE.—C. R. DAY, Arthur, W. Va. This inventor provides a drive adapted for use with automobiles and like vehicles, wherein auxiliary mechanism is provided in connection with the usual variable connection between the driving shaft and the driven shaft, for permitting the driver at will to connect the driving shaft and the driven shaft while the relative speed between the shafts is being varied.

AUTOMOBILE STARTER.—C. A. SMITH, 88 Canal St., Brattleboro, Vt. The starter is especially for use in automobiles, and wherein mechanism is connected with the engine shaft for rotating the same in a forward direction, capable of being operated by the driver from his seat, without dismounting, by a movement of the foot, and so arranged that there will be no interference with the engine after it has started.

END GATE FASTENER.—T. D. HARVEY, Newark, Tex. This invention provides a fastener for wagons and like vehicles and permitting a firm lock when locked, which may be readily and quickly disengaged when desired, and wherein the fastener consists of two sections, mounted for sliding movement longitudinally of each other, and having means for engagement to hold them in clamped position.

THILL COUPLING.—M. GRIMOAD, Box 666, Iron River, Mich. This invention relates to thill couplers, and one of the principal objects thereof is to provide an improved positive acting thill coupling, which when locked is unlikely to become accidentally unlocked and which may be readily secured to a thill or shaft.

Designs.

DESIGN FOR A GAME BOARD.—F. J. CLAVELOUX, 1405 F St., N.W., Washington, D. C. In this ornamental design the plan view shows a square-shaped game board, within which is an outer circle touching the edges of the square, the surface of the board being intersected with very small squares and blank spaces.

DESIGN FOR A CHILD'S RATTLE.—L. SAMETZ and A. R. SAMETZ, 430 Kent Ave., Brooklyn, N. Y., N. Y. In this ornamental design for a child's rattle, the frame of the article comprises a circular-shaped open handle, the main part of the rattle being a large ring holding five balls strung close together.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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The Chemistry of Shaving

How to cut the time of shaving in half and get an easier, pleasanter shave

THE composition of Mennen's Cream is such that it eliminates the unpleasantness of shaving peculiar to the use of "hard" soaps—sticks, powders, etc.

Mennen's makes re-lathering unnecessary, as the lather absorbs so much more water than that of "hard" soaps; it does not dry quickly, but remains moist to permit a leisurely shave.

Due to its peculiar beard-softening properties, it requires no "rubbing-in." Many men find this hard to believe, but one shave with Mennen's Cream will be absolutely convincing—no matter how tough the beard.

Finally, glycerin (usually extracted from soap to be sold as a profitable by-product) is present in extra quantity in Mennen's. Its soothing qualities, in addition to the absence of "free" caustic, account for the fact that this cream *does not bite or sting.*

Mennen's was offered to the public only after three years of experiments. Tens of thousands of men will now testify that it makes shaving unbelievably quick, easy and pleasant.

Cut out and mail the coupon now, for a trial tube

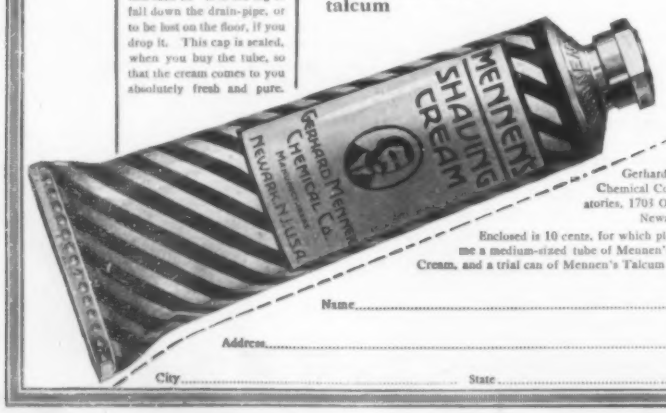
Prove for yourself how much easier and more pleasant Mennen's Shaving Cream makes a shaving. Wrap a dime in a piece of paper, and mail it with the coupon. We will send a medium-sized tube and at the same time, free, a trial can of Mennen's Talcum for men. This talcum is a neutral tint and will not show on the face. We ask only one thing, when you use Mennen's, follow the directions contained in every tube, for best results. GERHARD MENNEN CHEMICAL CO., Laboratories, 1703 Orange St., Newark, N. J.

MENNEN'S SHAVING CREAM

Cap can't be lost

Notice how big the cap of this tube is. It is too big to fall down the drain-pipe, or to be lost on the floor, if you drop it. This cap is sealed, when you buy the tube, so that the cream comes to you absolutely fresh and pure.

Mail the coupon with 10c for a trial tube of Mennen's cream, and a trial can of talcum



Gerhard Mennen Chemical Co., Laboratories, 1703 Orange St. Newark, N. J.

Enclosed is 10 cents, for which please send me a medium-sized tube of Mennen's Shaving Cream, and a trial can of Mennen's Talcum for men.

Name.....

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City..... State.....

Notes for Inventors

New Measurement Gages.—European gages of a new type consist of a tube containing a set of steel balls such as are commonly used for ball-bearings. At the ends, part of the ball projects, so as to form the end of the gage. Such gages are claimed to be exact to 1/200 of a millimeter, owing to good workmanship. The advantages are a small end surface and hence better manipulation, perfect polish of the ends, no danger of subsequent shrinkage after tempering, greater hardness and hence longer life, also increased solidity against rough handling. Owing to the cheap, though exact production of steel balls as against accurate gages, the new method is 60 per cent cheaper than rod gages.

Producer-Gas Locomobile.—A French inventor, J. B. Catteau, brings out a novel locomobile which contains a veritable producer gas plant with gas engine and radiator. On the front of the chassis is a suction gas-producer fed by anthracite or various coals, being provided with a scrubber. This latter is fed from a 100-gallon tank in the car roof. At the rear of the chassis is the gas engine, with a large flywheel pulley for belt drive to any needed device. Between engine and producer is a vertical wing-tube radiator of automobile type, provided with an air fan and water pump. Economy and easy handling make such locomobiles superior to the usual steam engine types, it is claimed.

Metallic Pump for Atomizers.—Toilet atomizers are likely to become useless because the rubber bulb cracks. This is now remedied by a new French device in the shape of an all-metal air pump exactly on the idea of a bicycle pump, but of diminutive size. What is valuable is that it fits on to any atomizer after the old bulb is removed, and the atomizer when thus fitted is quite durable. The pump is constructed to be operated by one hand while the atomizer is held in the other.

Folding Watch Holder.—It is well known that watches are injured by laying them flat upon a cold metal or stone table or the like, as this causes sudden changes of temperature of the mechanism which may act to break the spring, or at least hinder the good running of the watch. Hence a suitable watchcase is recommended in which the watch is protected from such contact. We noticed a very convenient little watch support that is especially practical for travelers' use, which folds up hinge-wise and can be carried in the pocket. One part of the hinged piece lies flat on the table and the other is raised up to an angle, the watch being held in an inclined position by hooks in top and bottom piece. The time can thus be read from a good distance, and the body of the watch is free from all contact.

New Egg-cup Device.—This neat little Parisian device, made of aluminium or silvered metal, consists of an upturned bowl-shaped egg holder mounted on an inverted hemispherical base about as in the familiar types. In the top bowl is fitted a stopper or plug which is itself hollow and carries a perforated head so that the stopper piece serves as a salt box. Within the bowl is a detachable ring-shaped egg-cutter with inwardly projecting teeth, by which the end of the egg is neatly clipped off by a partial rotation of the cutter. When not in use the whole is packed up and thus forms a neat device.

Flameless Powder.—Airships equipped with machine guns run a certain degree of risk from an explosion caused by the flame at the muzzle of the gun. Hence considerable study has been devoted to obviating this danger. This has now been accomplished by a young Florentine chemist named Guido Fei, according to the *Deutsche Waffenzeitung.* He is said to have recently given a demonstration before an Italian military commission of a new powder invented by him which burns without either flame or smoke and does not flare up on detonation. Its ballistic properties are said to be excellent. While specially useful for the guns of aircraft it will be of value in artillery and infantry engagements from the fact that it will not betray the firing line to the enemy.

Clothing a Winter Army

(*Concluded from page 215.*)

are notified where to send it; the mills are assigned to weave the cloth; in turn, the mills send their bolts to wide-scattered clothing shops where the staff has already sent patterns and specifications, and with the perfection of organization, the mill begins to grind, while the railways find means to snatch the finished product away to the depots for distribution.

Uniforms must be made, to the same number. The same principle applies, from the gathering of the raw material to the delivery of the finished article. Then, there are shoes.

Probably more attention has been given to shoeing an army than to any other detail of clothing. It is so important that the feet of the men be safeguarded in every way, for they have to march upon them, and upon marching depends the winning of battles, that countless experiments have been made to secure the most perfect fitting shoes, and from the result of these tests, the best has been adopted, an ideal. In addition to being of the greatest comfort, they must be sturdy, able to withstand to the last moment the ravages of a campaign.

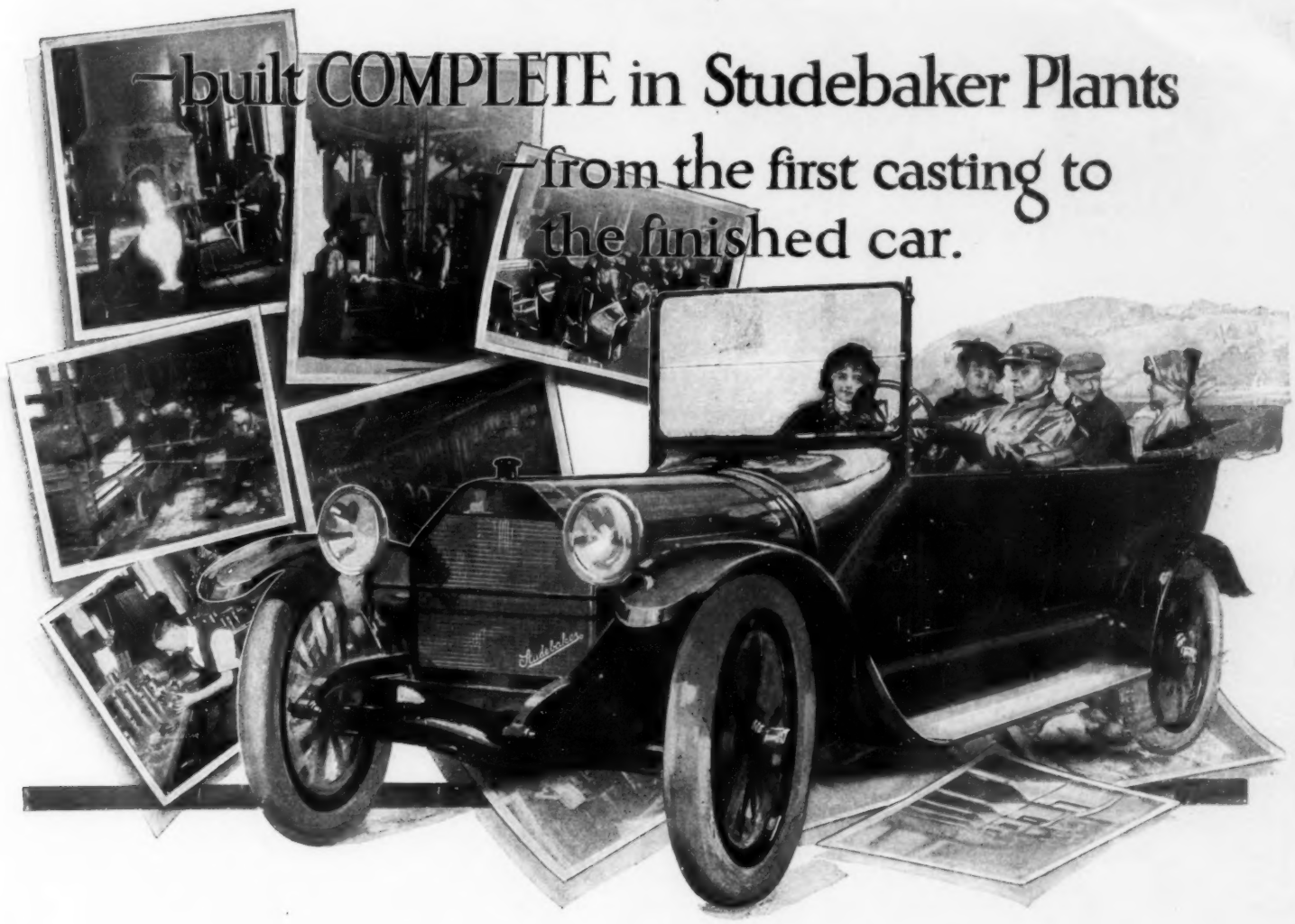
As a result of modernism, invention and organization, the American machine-made shoe has become generally recognized as the best on earth. Hundreds of thousands of American shoes were secured before the war, or American machines, upon which they could be made in the land; since the beginning of the war, millions of American shoes have been contracted for, the purchasers assuming the safe delivery of them, due to an enemy's vigilance and contraband declaration.

It is very nice for army regulations to specify the grade, quantity, and kind of underclothing. War, again, is not a nice thing, anyway it may be looked at, and very frequently one suit of underwear has had to serve, regardless of what should be. In winter time, the keeping out of cold supersedes the observation of nicety.

The Russians, for instance, rely upon sheepskin overcoats to keep out the cold. This has no bearing upon what they wear underneath, though winter-weight clothing is part and parcel of the issue, and when a war is to be of a duration which will embrace climatic changes, the outfit is for the coldest weather. Russia is a great sheep country and mutton a staple article of diet. Millions of sheep are killed there annually, and not only the army, but the peasantry rely upon the skins for warmth in winter. The problem which confronts the staff is simple, for the staff of the Czar knows where to get these skins with little trouble, so the problem of warmth is here answered. The German soldier, too, has been supplied with sheepskin winter clothing. The soldiers of France carry their winter equipment with them in summer, always ready for the field. As long as it has to be carried, it is carried by the individual in the easiest way, for even during the heat of summer the French soldier wears his overcoat unbottoned and rolled back at the skirts. There are heavier grades of uniform and underwear for the winter in times of peace, but in wartime there is but one weight—winter weight.

Of all the countries now involved in war, England has had probably the severest problem to solve with regard to clothing her men. A small standing army of 250,000 has been expanded to the neighborhood of 2,500,000. Complete uniforms must be supplied in a hurry, and the English mills have been running day and night, their output supplemented by purchase in other lands, mainly America.

Great Britain's colonial troops have come mostly from the tropics. Any man whose life has been spent in the tropics has been safeguarded by nature, which has made his blood thinner than that of a resident of a temperate or cold zone. In consequence, the cold of another clime cuts chillingly through the body, and special means are necessary to warmly clothe the tropical soldier. Heavy uniforms were prepared for the troops from India, including great coats and heavy



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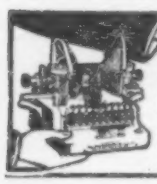

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blankets, and observers report that the Indian forces irked severely at the additional binding and weight of the heavy clothing at first, only to hug it with delight when the cold set in.

There is a great difference between the method of clothing supply in the United States army and any foreign army. In the first case a certain annual monetary allowance is made for clothing, which the soldier may draw in such proportion of clothing as he needs. For instance, if one man is harder on shoes than on breeches, he may receive or draw more shoes. Another man may have a special knack for getting wear out of shoes and none out of breeches. He may draw either so long as his clothing fund lasts, and the clothing all belongs to him. But in the foreign armies, the clothing belongs to the government, every piece, and as it is worn out, new is issued to the soldier.

When this Utopian army takes the field, 4,000,000 strong, it will be fully equipped. Assuming that the war will last a year, it will be necessary to renew the clothing at least three or four times.

A prodigious amount of clothing! Four to eight million blankets, for these constitute the bedding in the field. Sixteen to twenty million uniforms, blouses, breeches, headgear, shoes, underwear, shirts, etc., with at least six to eight million overcoats. Statisticians may easily figure out the number of thousand mile strips of material involved in their manufacture. And the delivery of the clothing to the combatant forces falls upon the overworked line of communication service, through the entire zone. Additional arrangements are necessary to supplement the daily shipments of food, forage, and ammunition to the line by rail and motor truck of the supply columns. It is thus evident how every part of the military machine hangs upon some other part—how the whole may not operate unless the parts function properly.

This brings the matter back to where it started—the staff. The General Staff is at the bottom of it all, for it has the duty of working it all out. The answer to the question goes back to the often repeated axiom: "In time of peace prepare for war."

The Flying Machines of the Warring Powers

(*Concluded from page 227.*)

war, with the exception of Russia, cannot supply machines to the army fast enough.

Russia's Enviable Position.

Russia is in the enviable position of having a large surplus of aeroplanes as she possessed at the beginning of August over four hundred machines and about two hundred pilots. The principal types are the Albatros, Aviatik and Rumpler, the Bristol, and the Deperdussin, Farman, and Nieuport. The majority were constructed under license in Russia. The only important machine of Russian design is the Sikorsky biplane, made in moderate sizes as well as in its huge form.

The various powers have appreciated the importance of repairs in the field and all have well equipped automobile workshops. The problem of supplying spare parts has also received careful consideration, and here again the automobile comes into play. Particular attention has been paid to the problem of aeroplane transport by road or rail. In tractor biplanes the plane sections on either side of the fuselage and central cellule are quickly detachable. Indeed a few models have folding wings. With monoplanes the wings are easily detached. Some of the smaller machines of this type can be transported by motor truck when the wings are detached, but generally speaking the fuselage is towed along the roads.

Very little reliable information has been obtainable in regard to the types of machines the French factories are now producing. It is a known fact, however, that the Blériot factory at Buc has been requisitioned by the government for the production of the marvelous little Caudron biplanes. The reason given for the refusal of the government to take any more Blériot machines is their rather poor

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climbing qualities, notwithstanding the fact that Blériot brought out a new model supposed to be an improvement in this respect. Up to the outbreak of war the Morane machines were built by Llore and Olivier and then sold to the Morane-Saulnier firm. Better arrangements have certainly now been made for the production of this machine.

The British government has ordered seven replicas of the "America" from the Curtiss Aeroplane Company. Large orders from abroad are also being filled for Sperry gyroscopic stabilizers. It would seem, therefore, that the American aviation industry may soon come in for its share of prosperity at last.

A New Casing for Sausages*

By W. P. Cohoe, E. C. Fox, and A. J. Acton

CASINGS for sausage meats at present in use consist of the larger intestines of the ox, sheep, and hog, known in the trade as bungs; the gullet of the ox known as "Weasands," and the smaller and middle intestines of the ox. For small sausages the smaller intestines of the sheep and hog are used.

No exception can be taken to them providing proper precautions are taken to insure their purity. In the large packing houses the conditions of purity are more closely watched than in small butcher shops and abattoirs, but a sanitary substitute is highly desirable.

An ideal casing should possess the following properties:

The raw material should be pure and uniform. The process of manufacture should not permit any possibility of contamination by disease germs. The finished product should be of uniform chemical composition. It should be mechanically suitable. It should have a pleasing physical appearance. It should not provide a surface upon which mold and other organisms can readily propagate. It should not contain substances injurious to the human organism. It should be, although in many cases not necessarily so, edible. If possible it should be digestible. It should be capable of being kept, stored, and transported, under ordinary conditions, for an indefinite period of time, without deterioration.

In order to find a substitute for the present casings, a survey of the field of possible raw materials was made, and it was finally decided to try cellulose (hydrate) and to use the viscose reaction of Cross and Bevan.

Bleached sulphite wood pulp is used as the raw material. This is mercerized by the action of caustic soda solution, washed and treated by carbon disulphide.

On the addition of water swelling takes place, giving a thick viscous solution without a trace of fibrous structure. This material is then manufactured into tubes, and passed into a salt solution, which converts it into a yellow jelly. The by-products of the reaction are largely removed by washing in mixed solutions of sodium sulphides and bisulphites. Many of the salts may be removed by heat, either by the direct action of steam, or by passing the tube through a hot solution, either of salts, alcohol, glycerin, and many other substances.

The tube, which now consists of cellulose (hydrate) together with adhering sodium salts, is washed thoroughly in boiling water. The length of time necessary to accomplish this may be first determined by an ash determination. When the amount of ash falls to an amount equal to that in the original bleached sulphite pulp, freedom from impurities is assured. The tube is finally dried, conditions, and rolled up ready for shipment.

Should colorless product be desired, the tube may be bleached after the hot wash. In this case it is led first through a hypochlorite solution, then washed in water, then led through thiosulphate solution, and finally washed in water.

Bleached sulphite pulp is pure, abundant and uniform. The chemical treatment it undergoes insures an aseptic con-

* Read before the Canadian Section of the Society of Chemical Industry, and condensed from the *Journal*.

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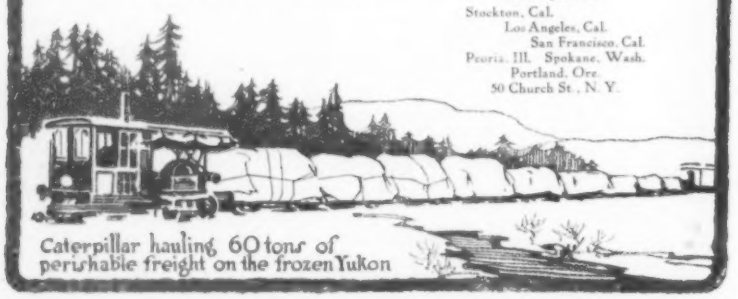

Caterpillar hauling 60 tons of perishable freight on the frozen Yukon

Where's the Money Coming From?

THE children,—the house—the butcher and the gas company—all need more, and more and more money. You can't do any more work—and you can't do any different work. What are you going to do? That's your problem.

Your answer is here. You can get more money—for less work. When a corporation wants to make more money without increasing its plant it calls in a great Efficiency Engineer—like Harrington Emerson. Now—you can do the same for yourself; for Harrington Emerson has applied the principles which he has already given to 200 corporations to you, as an individual in the

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Through this course already 5000 men are on the way to get what they want in the quickest, shortest, easiest way. The Treasurer of the biggest bond house in the Northwest saves hours every day—an author in New York does twice as much work and has more time to sell that work—a State official saves his State $3,000 on one job.

The Efficiency Movement has swept the world because it has brought to men who saw no way out a new light to success. Other nations have profited—other nations make the most of their time and their talents; but we in this country—with our abounding wealth, have been prodigal with natural resources, with mental resources, with time. Now we must stop and reorganize.

And above all, it is the individual who must reorganize himself, because it is he who is the basis of the trouble. Let the Emerson Course teach you to conserve your brains, your time—for these are your capital—just as money and machinery are the capital of a factory. Learn to invest them right. There's more coming to you out of life—Get it. Get the money and rest and success you ought to have. You won't work longer—you'll work less. You are full of unused energy. Consider country people and city people. The rapidity of the city man's life bewilders the country man. A day in New York is a terror. But give him a year in the city and he will keep the pace as well as anyone. He will get ten times as much out of himself—and he won't be working any harder. That's what Efficiency will do for you who are already in the city. It will attune you to a new gait—a new zest and snap—and things will leap along where now they crawl.

These principles are not casual ideas of Mr. Emerson's. They are the scientific principles he has developed in forty years of study. He has applied them in over 200 factories, railroads, and other organizations. They are studied by other Efficiency Engineers in America, England, France, Germany and other countries who have learned them from Emerson. His big organization in New York—(he has 40 assistants) has taught Efficiency to steel mills and railroads, factories and publishers.

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It's too big to explain—too new and too vital. Send the coupon for the first lesson *free*. Follow its instructions. Then if you feel your work easier, and its results bigger—you can have the whole course. We have seen the tremendous effects of this one lesson. We have before us the letter of the man who says it "woke him up."—the letter of the man who was on the wrong road when this lesson set him right. We know—that's why we're glad to give you this lesson free—so you can be set on the right way without loss of time.

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Send me particulars about your Course in Personal Efficiency and Story of Emerson. Also absolutely *free* of charge the first lesson.

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dition. Inorganic impurities are limited to the small proportion of ash, 0.50 per cent mainly, consisting of alkalis and alkaline earths.

The experience in Canada with the use of the new product showed that its mechanical properties were satisfactory. Although the origin of the casing was known to the store managers, yet the man behind the counter, who had been handling sausages for years, did not recognize the change of material.

Cellulose (hydrate) casings are transparent and colorless in thin films when unbleached, and when bleached are colorless in all usual thickness. The surface is smooth and glossy, and does not easily afford a lodging place for mold or bacteria.

Taking the mean content of 1.8 per cent of cellulose in American wheat, obtained by Richardson, after 407 analyses (Am. 6,302) and remembering that the casing of a sausage is from 1.04 to 1.12 per cent of its total weight, it will be seen that the eating of many of the prepared breakfast foods made from whole wheat, e. g., shredded wheat biscuit, involves a larger percentage of cellulose than does the eating of a sausage with cellulose (hydrate) casing.

Furthermore, it can be shown that cellulose (hydrate) is in a form more susceptible of chemical attack than is the hard covering of the cereal grains.

Edibility is demanded only in the case of small sausages, the casings of which consist of intestines of the sheep or hog. The casings of sausages of the Bologna variety cannot be masticated in any reasonable length of time, and are simply coverings or food containers. The meat of the sausage also does not adhere to the casing as it does to the old ones. A Bologna casing made of cellulose (hydrate) can, however, be masticated. In such a case, a soft non-irritant mass is produced. In the case of the smaller sausages, the thickness of the casing is very small (0.004 to 0.006 inch).

Activities of the American Museum of Natural History

IN his annual report President Osborn stated that the Museum had made explorations in three continents during the past year, and still had twenty-nine expeditions in the field.

The museum is conducting an expedition in the Arctic regions, two in South America and three in Africa. The Congo expedition has gathered its collections, amounting to forty-five tons, at Stanleyville, and is sending it down the river for transportation to New York. For three years extensive field operations have been carried on in South Africa, other expeditions have been sent to Colombia, Brazil, and Paraguay, while an expedition to study volcanoes is leaving for the West Indies.

More than 5,000 specimens collected by the Roosevelt expedition to Paraguay and Brazil have been received, as well as the Schrammen collection of over 5,000 fossils. A collection of 265 sharks and other fishes from Japan has been added and the collection of Peruvian pottery from Nasca, Peru, comprising about four hundred pieces, is now on exhibition. Another addition is the Howell collection of meteorites.

Attention is called to the need of money to carry on the work of the museum as the municipal appropriation has been decreased and the entire income, with the exception of restricted amounts, is required for maintenance.

Toothbrush Without Handle.—The rubber toothbrush is a familiar article at present, but a European inventor recently had the idea to dispense with the usual handle and to make a small and convenient article by forming the rubber brush in the shape of a glove-finger, which is studded with the usual projecting points. This is much more convenient to use than a toothbrush of the ordinary kind because the finger can explore all parts of the mouth, and the operation is carried out more easily by the finger than by the use of a stiff handle. Its small size and no doubt low price is also a recommendation.

How did it happen?

The twisted wreckage in the ditch doesn't tell the cause of the accident. All the driver can remember is the shock. But this we know—suddenly the car got beyond control. The momentum of a heavy car and the power of forty or sixty horses broke from the bondage of a puny foot lever—and then—smash!

Why? The brakes failed. The brake lining was worn out. Likely enough it was only half brake lining anyway.

You *must* have good brake lining—100% brake lining.

Thermoid
HYDRAULIC COMPRESSED
Brake Lining-100%

Brake lining, to be 100%, must be brake lining all through. Not merely on the outside. It must be trustworthy to the last.

Thermoid retains its 100% gripping power even until worn *paper-thin.* Hydraulic compression makes it one solid, single substance of uniform density clear through—instead of being loose and stringy (and friction-shy) on the inside, as is ordinary woven brake lining. Guard YOUR safety with Thermoid.

Thermoid Rubber Co.
Trenton, N. J.

Our Guarantee: Thermoid will make good—or no will.

Cannot be burned out nor affected by oil, heat, water, gasoline, dirt.

This combination square was the first tool invented and patented by Mr. L. S. Starrett. It combines a rule, try-square, level and bevel and may be used as a plumb or depth gage. Sizes, 4" to 24". Prices at any hardware store 75 cts. to $2.75. Popular size 12"—price $1.50.

Starrett Tools

are the acknowledged standards of precision the world over. The line includes steel rules, tapes, and squares; levels, bevels, protractors, calipers and dividers, micrometers, vernier calipers, gages, and many other tools for mechanics.

Every man should send for free catalog No. 20-B, describing 2100 styles and sizes of tools.

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WORLD'S GREATEST TOOLMAKERS
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Build This Motor Boat Yourself—IT'S EASY!

ONLY $37 for pattern and frames of this boat

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Write for free book showing many models. Speed boats, family launches, cruisers, sailboats, rowboats, canoes, etc. Boat Patterns, $3.00 and up. Write today.

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Join the thousands who revel in this popular sport. Get a sturdy, light, low-priced "Old Town Canoe" and unfold the glories of the great outdoors. "Old Town" is the canoe used by experienced scouts and guides. 4300 canoes just finished. Write for catalog of canoe views and name of dealer in your town.

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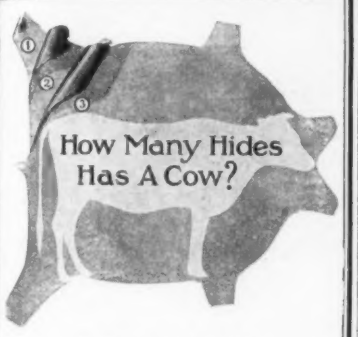

The Truth About Leather

In a recent defensive circular to the auto trade, leather manufacturers define leather as "the skin or hide of an animal, or any part of such skin or hide, tanned or otherwise prepared for use."

But since whole hides are too thick for upholstery and the under fleshy portion must be split away from the grain side to make it thin enough, why should the two or three sheets into which the wastage is split, be called leather? Although artificially coated and embossed to look like real grain leather, they are weak, spongy, and soon crack, peel and rot.

DU PONT FABRIKOID
REG U S PAT OFF

MOTOR QUALITY
For Automobiles

CRAFTSMAN QUALITY
For Furniture

is frankly artificial leather, guaranteed superior to coated splits. Its base is cotton fabric, twice as strong as the fleshy split. It is coated much heavier and embossed in the same way.

America's largest auto makers adopted it for upholstery because it outwears coated splits.

That foremost furniture maker, S. Karpen, says: "The cheap split leathers should be entirely eliminated in furniture upholstering."

Two-thirds of all "leather upholstery" is coated splits. Demand superior Fabrikoid on your car, buggy or furniture, and Fabrikoid Rayntite tops, guaranteed one year against leaking.

Small Sample Craftsman Quality Free, or a piece 18" x 25", postpaid, 50c. It is on sale by John Wanamaker, Philadelphia; McCreery & Co., Pittsburgh; J. & H. Phillips, Pittsburgh; John Shillito Co., Cincinnati; Stix-Baer-Fuller Co., St. Louis; The Palais Royal, Washington, D. C.; Stewart & Co., Baltimore, Md.; D. N. & E. Walter & Co., San Francisco, Los Angeles, Seattle, and Portland; T. Eaton & Co., Ltd., Toronto and Winnipeg; Davison-Paxon-Stokes Co., Atlanta, Ga.; Du Pont Fabrikoid Co., 90 West Street, New York, and upholstery dealers generally.

DU PONT FABRIKOID CO.
Wilmington, Delaware
Canadian Branch: Toronto, Ontario

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13041) W. J. R. asks: Will you please inform me through the medium of your paper or otherwise of the visibility of anything under water with respect to an aeroplane? How far can they see into the water, and can they, as they go higher to certain limits, see farther or deeper? Did they find the British submarine, which was sunk during January last, as has been stated, at a depth of 200 feet? A. We have consulted a naval aeronautic expert on the visibility of submarines from an aeroplane. He states that if the surface of the water is smooth, and the water is fairly clear, a submarine can ordinarily be observed visually from an aeroplane at any depth the submarine is likely to travel, which is usually not over 100 feet. Experiments have been made at Guantanamo, Cuba, and Annapolis, Maryland, and in the latter case the submarines were able to avoid observation at first by sinking to a muddy bottom. But the aviators soon learned to pick them out by some sign, such, for example, as escape of air bubbles. The British have hitherto made no provision for carrying aeroplanes and launching them from cruisers or dreadnoughts far from a base, and this is doubtless one reason why more has not been done by the British aeroplanes in operating on the German fleet. We have no information regarding the finding of the submarine in question. Vision below the surface is doubtless not improved by rising to a great height above the surface.

(13042) O'R. & H. asks: Why is the proportion of CO^2 in the atmosphere practically constant in all seasons of the year? CO^2 is being constantly produced by the exhalation of animals and by volcanic action, etc. Plant life absorbs carbon dioxide, breaks it up, stores up the carbon and gives off the oxygen. Most books cite this explanation for the fact that CO^2 remains practically constant in proportion in the atmosphere. As far as we have been able to determine, the books and authorities do not seem to take into consideration the fact that vegetation lies dormant during the winter season and necessarily cannot absorb as much CO^2 as in the summer time. How, then, is this excess of carbon dioxide produced during the winter season taken care of? A. We have never seen any discussion of the point you raise in reference to the invariability of the amount of carbon dioxide in the atmosphere. It is found to be about 0.0003 per cent, or 3 parts in 10,000 parts of air by weight, in all places where the air is reasonably pure. In many places there is more than this. We should explain the matter by saying that this small proportion is still so enormous a quantity that the adding or subtracting what animals supply in a winter when plants are not drawing upon the supply does not affect the grand total. It is like bailing water from the ocean, yet is the ocean full. Then again, plant growth does not cease over the largest zone of the earth, the Torrid, all the year through. The weight of the air is five sextillion tons; or 5 followed by 15 ciphers. The carbon dioxide weighs about 1.5 followed by 12 ciphers. This quantity is inconceivably enormous, and may well be considered invariable by any power of men, animals and plants.

(13043) H. W. M. asks: I am interested in the matter of lightning arresters as used on modern telephones. What are the best references on this matter? What is the prevailing opinion on the matter? Is lightning arrester a misnomer? Will they really offer any protection from lightning discharges? Might a discharge take place, such as to harm a person, without doing any harm to the instrument itself? A. Lightning arresters are by no means a misnomer. They act to cause the electricity to pass to the earth, across the gap of the arrester. Every transmission line and every telephone or telegraph line is probably protected, so that the instruments are rarely burned out in a thunder storm. A discharge might take place which would do harm when there is an arrester; but most lightning flashes can be carried by the arresters now employed. It is good policy to protect against the sort of discharges which can be handled, although there may be some which cannot be controlled. The best references are to the electric companies which have long transmission lines over the country where electric storms are frequent, as in the mountains of the west, or from Niagara Falls to the east and west; or to the Western Union Telegraph Company, and the Bell Telephone Company.

(13044) R. W. asks: 1. What is the principle on which the chemical weather glasses work? Crystallization of the mixture is supposed to indicate falling weather. The tubes are sealed so that pressure of the air or humidity could not be communicated to the contents. A. The so-called chemical weather glass contains camphor dissolved in alcohol. A very slight change in temperature changes the amount of camphor which can be held in solution by the alcohol. Humidity and the pressure of the atmosphere have no influence upon its condition. 2. The molecules or atoms of any substance are supposed to be in a state of very rapid vibration. If this were the case, would not there be some friction and the constant production of heat? A. In the

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If you have 1000 or more square feet of concrete floors we will send you this sample bottle free.

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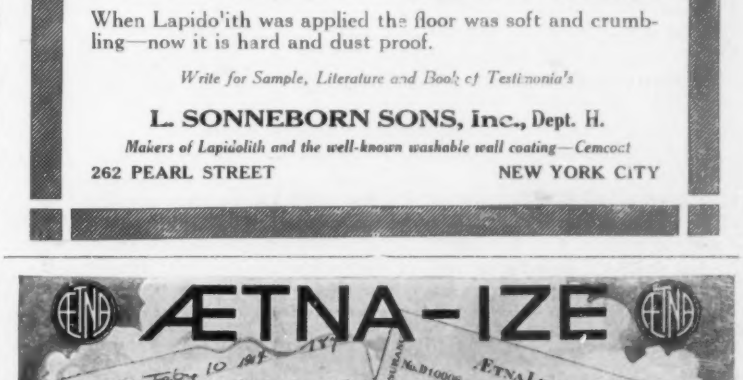

Two Checks—
A Vital Story for You

IN these two checks lies a story that might be yours. Paul A. Wilson paid $50 for Ætna Accident Insurance for four years. He was killed in a train wreck. His policy originally called for $10,000, but it had increased $1,000 each year without his paying one additional cent. And his being killed while traveling doubled the $13,000.

So this wife received $26,000 to make her lonely way a little less hard.

You may be the next one. You are never safe, even in your own home. It is not only railroads, street cars and automobiles that kill and maim. Out of 50,000 accident claims paid by the Ætna in six years, more than 6,000 were for home accidents. A slip on the stairs, a cut with a razor, a sliding rug; all these spell disaster—and sometimes death. You can't foresee and you can't avoid accident, but you can take care of yourself or of those who stay behind you. Ætna-ize and be safe.

A $10,000 Ætna Accumulative Accident Policy will pay:

$20,000 for death or loss of limbs or sight by travel, elevator, street car or burning building accident.

$10,000 for death or loss of limbs or sight from any other accident.

Half the above amounts for loss of one hand, foot or eye.

These payments increase each year the policy is carried, until in the sixth year and thereafter they are 150 per cent. of the original amounts.

$100 a week, as long as you live, if you are totally disabled by a travel, elevator, street car or burning building accident.

$50 a week for disability from any other accident.

This is your chance to relieve your mind of worry—to know that you have done your best. Send the coupon now, while it is at your hand. Next month—next week—tomorrow—may come the accident. **Send the coupon today.**

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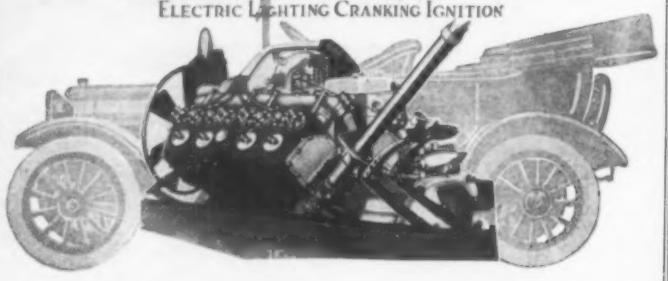
The largest company in the world writing Life, Accident, Health and Liability Insurance

DELCO

ELECTRIC LIGHTING CRANKING IGNITION



The Supreme Test of Delco Ignition

THE advent of the high speed eight-cylinder motor has called upon Delco ignition to perform feats heretofore believed impossible.

These engines frequently reach a speed of 3000 or more revolutions a minute.

That means 12000 sparks distributed among eight cylinders every sixty seconds.

Twelve thousand times every minute the contact points in the distributor head must open and close the electric circuit.

If you could see the twelve thousand jumps of high tension current you would say the flow of fire was continuous.

Yet each spark is absolutely distinct and separate, and is delivered on a time schedule that does not vary one ten-thousandth part of a second.

Never before has any ignition system been called upon to perform such a feat.

The other eight-cylinder motors turning over 1500 to 2,000 revolutions a minute are simple problems in comparison.

And yet this same Delco ignition—the ignition that has made possibly the high speed eight, is identical in every respect with the the ignition that is used on every Delco equipped car.

The high speed eight is simply its supreme achievement.

Delco ignition insures a hot, constant spark in starting, in running at low speeds or in covering a mile a minute.

The same hot spark is there at 20 revolutions a minute as at 3,000. The same maximum Efficiency is insured in the low speed four as in the high speed eight.

And always remember this—Delco ignition is simply one function of complete Delco Equipment.

The cranking and lighting of your Delco equipped car are just as efficient, just as dependable under all operating conditions as is the ignition.

Two hundred thousand Owners driving 200,000 Delco Equipped Cars, furnish world wide proof of Delco leadership

The Dayton Engineering Laboratories Company
Dayton, Ohio

production of heat by collision, both weight and velocity of the moving weight are involved. The weight of a molecule is so small that no appreciable amount of heat could be evolved in a very long time. An infinitesimal weight would require an infinite time at a finite velocity to produce any small change of temperature in ponderable matter. 3. What is the nature of the magnetic flux that is supposed to circulate in a magnet? A. The magnetic flux consists of imaginary lines of force, or the lines along which a magnet pole would be urged by the magnetic force. They are hypothetical lines only, but are suggested by the fact that iron filings arrange themselves in lines under the action of the force of a magnet, covering some spaces and leaving other spaces bare of filings.

(13045) P. J. P. asks: Could the steamship "Titanic" reach bottom, no matter what the depth? A. Anything which will sink in water at the surface will sink to the bottom anywhere, in the deepest place in the ocean or along the shore. This is because water is nearly incompressible, and a cubic foot of water at the bottom of the deepest place in the ocean weighs only about one-twentieth more than at the surface. The difficulty in this matter arises from confusing pressure with weight. A body sinks in water when it weighs more than the same volume of water weighs. A cubic foot of fresh water weighs 62.4 pounds. Anything which weighs more than this will sink in fresh water. Salt water weighs about 64 pounds per cubic foot on the surface, although this varies somewhat in different parts of the ocean. At the bottom it weighs only 3½ pounds more than at the surface. Steel weighs 7.7 times as much as water, hence the ill-fated "Titanic" went to the bottom with a great velocity when her compartments were burst in by the pressure of the water. This took place as she went down, according to the reports of the explosions heard, and the water filled her completely. There was then little to prevent her from sinking, only the woodwork and the bodies of the dead. All this was carried down to the bottom of the ocean. Calculation shows that she probably struck with a high velocity. Pressure does not prevent motion. We are under a pressure of 15 pounds per square inch, or more than a ton per square foot, by the air which surrounds us, but we fall with great velocity, or move about through the air with ease. It is the same with water pressure. When a diver goes down 100 feet, he is under a pressure of nearly 4½ tons per square foot, but he can still move around.

This question has been asked so many times lately that we give it space again. You will find a number of articles in the SCIENTIFIC AMERICAN at the time of the "Titanic" disaster. One editorial, which covered the subject, appeared in Vol. 106, No. 17, which we will send for ten cents.

(13046) C. L. V. asks: Will you kindly tell me what preparation or chemical solution I can use to make wood burn with a blue or other colored flame for use in a fireplace? A. Artificial drift wood, which burns with a greenish or blue flame like the wood from an old wreck, may be made by soaking pieces of soft wood, white pine or white wood, in a strong solution of copper chloride in water and drying the wood. A pound of copper chloride will serve to prepare a large quantity of wood. The best way to proceed is to set the pieces of wood, split as for kindling, end wise in a wooden, or better, an agate pail. The solution will soak into the wood better if the upper ends of the sticks are out of the water and dry. Do not use an iron pail because it will be ruined by corrosion from the solution. The addition of an ounce of lithium or strontium chloride will give red flashes in the flame.

(13047) D. B. writes: In your issue of December 19th, 1914, I notice an answer to Mr. L. A. DeBois's letter, which appeared in your War Issue No. 3, regarding lightning and the automobile, by Mr. C. Langley Johnson of Santiago de Cuba. Mr. Johnson ends his article doubting if ever anyone had been struck by lightning in an automobile. In answer will say I read in a Spokane, Wash., daily last fall where two couples were riding in an automobile, the two men seated in the front seat were struck by lightning, killing them instantly, yet the chauffeur clung to the steering wheel in a limp position, running from side to side of road till the car ran over an embankment, injuring the women, but the men were dead from the shock. A. The position taken by Mr. Langley C. Johnson in the letter referred to seems to us a sound position, that the rubber tires offer some degree of protection from lightning. He says they do not offer enough to protect from a direct lightning flash, but might influence a discharge to save a life which otherwise might be taken. That an instance has occurred in which life has been taken does not break the force of this argument. We think persons in an automobile would be quite safe if the cover had metal bows and was up over their heads. Still there is no absolute safety from a lightning stroke excepting in an iron box or cage or entirely below the surface of the earth.

(13048) A. H. B. reports a Leclanché wet battery which has served to ring a door bell for over twenty-one years. It was put in in December, 1893, and is still doing good service. It is of the carbon cylinder type with the zinc hanging in the center. The cell is paraffined and the top closes the joint, so that the evaporation can only take place around the zinc. The report is that no zinc, water, nor sal ammoniac has been added in all these years. There is now about an inch of the solution remaining in the jar. The slowness of the evaporation can be accounted for by the closeness of the joints at the top of the jar. There is the usual alum crystallization in the bottom of the cell. The amount of service called for each day is not stated. But under any conditions of service the battery is perhaps the oldest on record and goes to show the superiority of a well made wet cell over the ordinary dry cell.

New Motorcycle Type

Electric Light Every motorcycle saddle—New coaster brake—motorcycle mud guards, stand and parcel rack—motorcycle pedals—long rubber grip motorcycle handle bars—re-inforced motorcycle frame. Flat Red Tread Chicago Tires—beautiful finish. Write.

Pay as You Ride A small amount down brings you the 1915 Arrow. Pay just a little each month while you ride. Write for our rock-bottom direct offer.

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UNMATCHED SPEED

Extra Power—No Vibration Speed that runs away from any other rowboat motor—power to carry heavier loads—no vibration to shake the boat.

The 2-Cylinder **KOBAN ROWBOAT MOTOR**

This wise man's choice this year. Last season proved its mettle. Absolutely dependable—starts easy—reverses by simply pressing button—weedless propeller.

2-CYLINDER—RACER TYPE

Has 2 opposed cylinders—that's what removes vibration. 3 H.P.—nearly double that of other motors—speed like propeller. Best constructed rowboat motor on the market.

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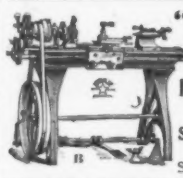
U. S. MOP COMPANY, 270 Main St., TOLEDO, OHIO

This small picture shows mop on the floor. It spreads out and is held down at the floor at all points.

LATHES AND SMALL TOOLS



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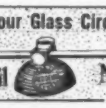

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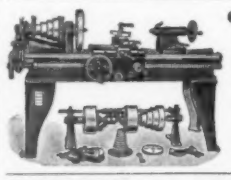

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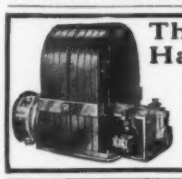

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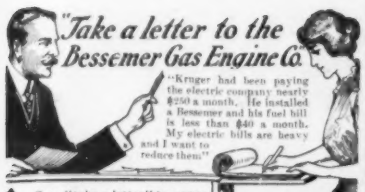
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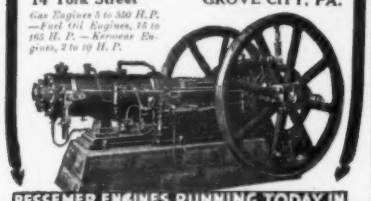

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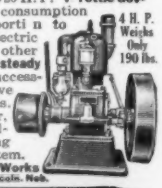

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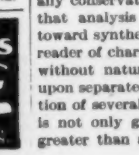

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NEW BOOKS, ETC.

HEATON'S ANNUAL. The Commercial Handbook of Canada and Boards of Trade Register. 1915. Toronto: Heaton's Agency. 8vo.; 442 pp. Price, $1 net.

Now in its eleventh year, Heaton's Annual has become an almost indispensable desk book for business men who in any way come into relation with the Dominion. The Canadian customs tariff and regulations is one of the important subjects comprehensively handled There is much encyclopedic information with references to government publications for details. Every commercially important town is briefly described, as are also those agricultural districts toward which immigration is directed. The industries and opportunities of the country are listed, so that manufacturers desirous of establishing a Canadian branch may be reliably guided in their decision as to locality. A new feature of the Annual is "Where To Find It," which is really an economic bibliography of government reports and standard publications.

THE NATIONS AT WAR. The Birth of a New Era. By L. Cecil Jane. New York: E. P. Dutton & Co. 12mo.; 228 pp. Price, $1 net.

In this series of papers Mr. Jane reaches rather extreme conclusions. There is much sound, not to say shrewd, observation upon such subjects as athleticism, feminism and religion, though the treatment errs upon the side of the academic. The author takes for granted the success of the Allies. While admitting that they will reorganize the Continent in their own interests, he adds that their interest is assuredly the interest of all other states, large and small. He commits himself to the opinion that the end of the war will usher in a lasting, universal peace; he bases this opinion mainly upon the titanic nature of the conflict. "Men are moved by nothing more readily than by the immense." This sense of immensity is to change Nature itself. In this conclusion optimism would seem to part company with common sense. Even should the victory of the victorious prove sweepingly complete—which is unlikely—neither history nor observation warrants us in expecting human nature to change in any abrupt or radical way.

THE DAILY NEWS ALMANAC AND YEAR-BOOK FOR 1915. Compiled by James Langland, M.A. Chicago: The Chicago Daily News Company. 8vo.; 727 pp.

BROOKLYN DAILY EAGLE ALMANAC. 1915. Brooklyn, New York: Eagle Building. 8vo.; 608 pp. Price, $1.

The word "almanac" has of late years been stretched to cover annual encyclopedias containing astonishing amounts of condensed information the distinguishing feature of which is the world's progress for the year. Two such annuals are the Daily News Almanac and the Eagle Almanac, issued by two of the great newspapers of the country. The alertness of the compilers, and their zeal in bringing their work down to date, is evidenced by the inclusion in the latter volume of the Italian earthquake of January 13th, 1915. This book has some useful maps supplementing its specialty of presenting most fully New York city and Long Island interests. These show a wealth of useful detail. The Daily News Almanac has, among other countless features of appeal, the text of the various white, yellow and orange books issued by the nations at war. Both volumes devote much space to war facts and statistics, and both of course carry the innumerable tables and compilations dealing with our national activities, from athletics to government and religion.

THE AMERICAN WHITAKER ALMANAC AND ENCYCLOPEDIA FOR 1915. C. W. Whitaker, M.A., F.S.A., Editor. New York: Doubleday, Page & Co. 8vo.; 648 pp.

The American Whitaker first gives us a fund of astronomical and weather lore, as befits its primary purpose. Our government, immigration, population, the growth of our cities, our paupers and insane, our societies, institutions and colleges, banking and finance, and crop production is all presented in the briefest way consistent with accuracy. The states, territories and dependencies of the United States are dealt with at large, and there is more condensed information concerning foreign powers. In the war section is a long summary of the great war, covering both the land engagements and naval operations during 1914. There is a full index of the 9,000 facts presented, which renders any desired information readily accessible.

CHARACTER READING THROUGH ANALYSIS OF THE FEATURES. By Gerald Elton Fosbroke. New York: G. P. Putnam's Sons, 1914. 8vo.; 193 pp.; 56 illustrations from original drawings by Carl Bohnen. Price, $2.50 net.

Of late, physiognomy has been put forward as an art that could be of inestimable service in the realm of business and industry. Mr. Fosbroke has collated much theory in regard to the relationship of features and traits, with the invaluable assistance of an artist who has entered thoroughly into the spirit of the investigation. The features are separately examined, and conclusions drawn from many lives. The various temperaments receive careful consideration, and the uses to which physiognomy may be put are briefly sketched. The author's claims are generally conservative; and we would add the caution that analysis should be only a conscious step toward synthesis. For this reason the intuitional reader of character is always superior to one who, without natural aptitude, bases his conclusions upon separate features or largely upon a combination of several. It is a case where a combination is not only greater than any of its parts; it is greater than all of them.

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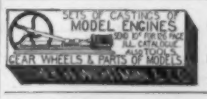

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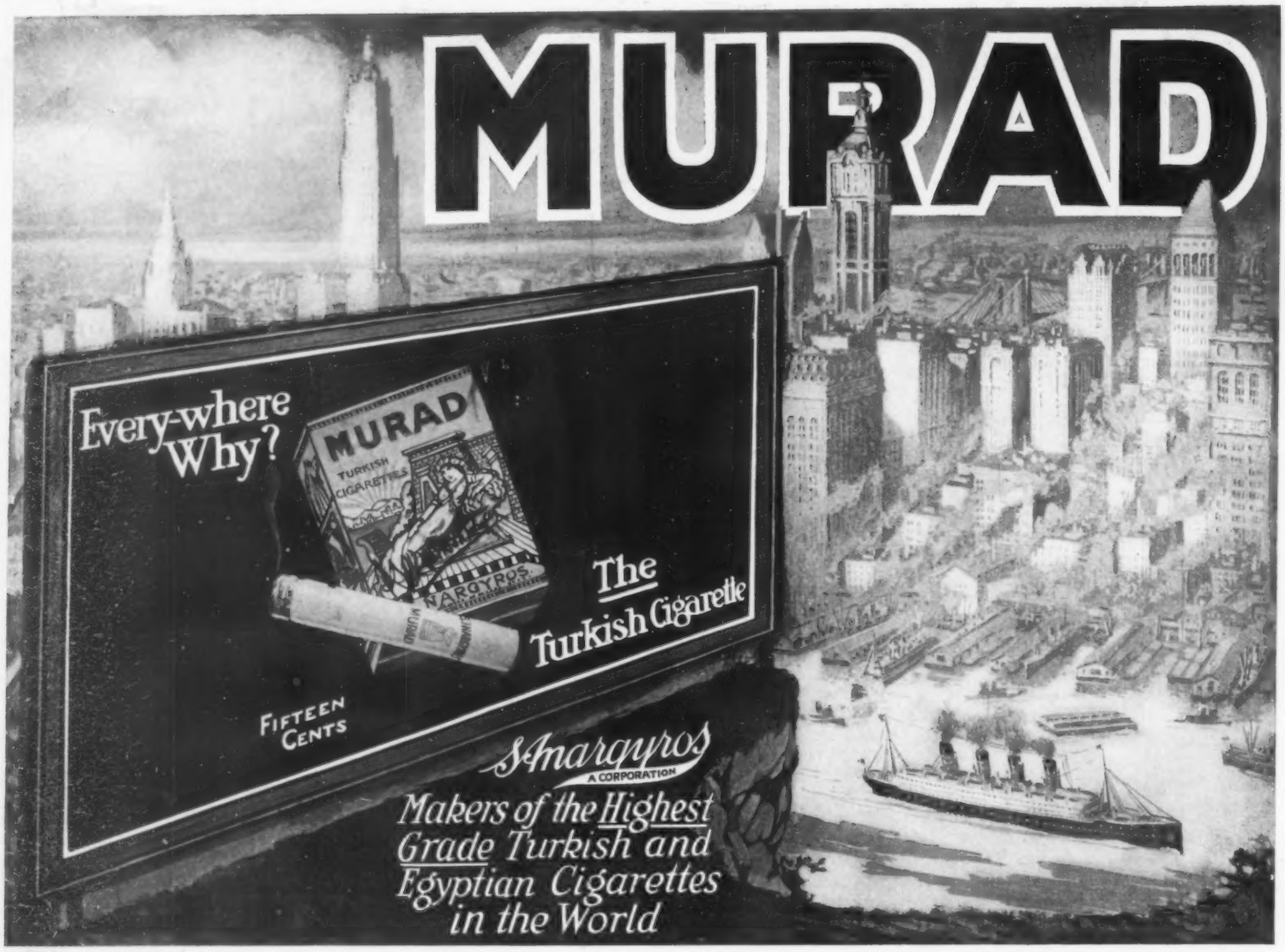

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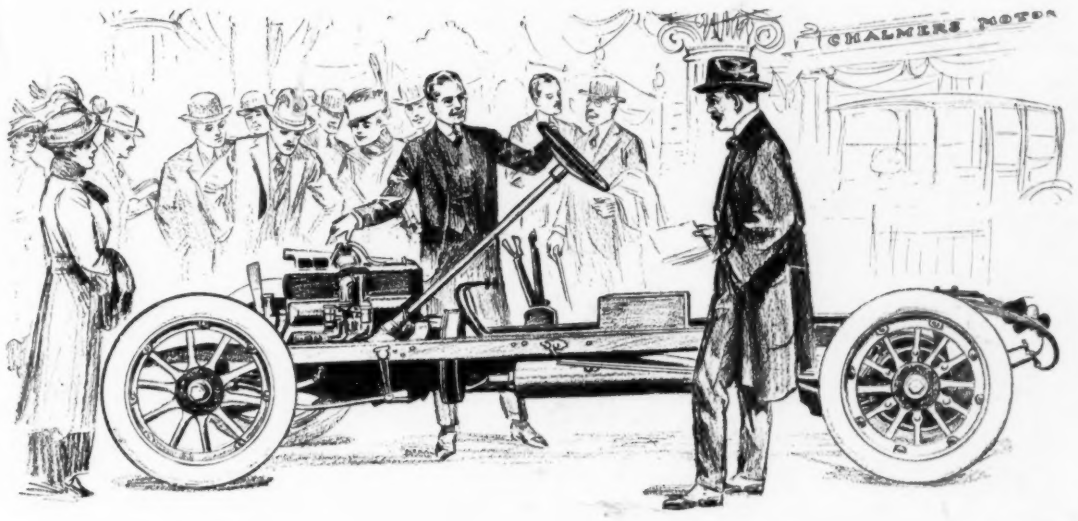

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